SCIENTIFIC AMERICAN

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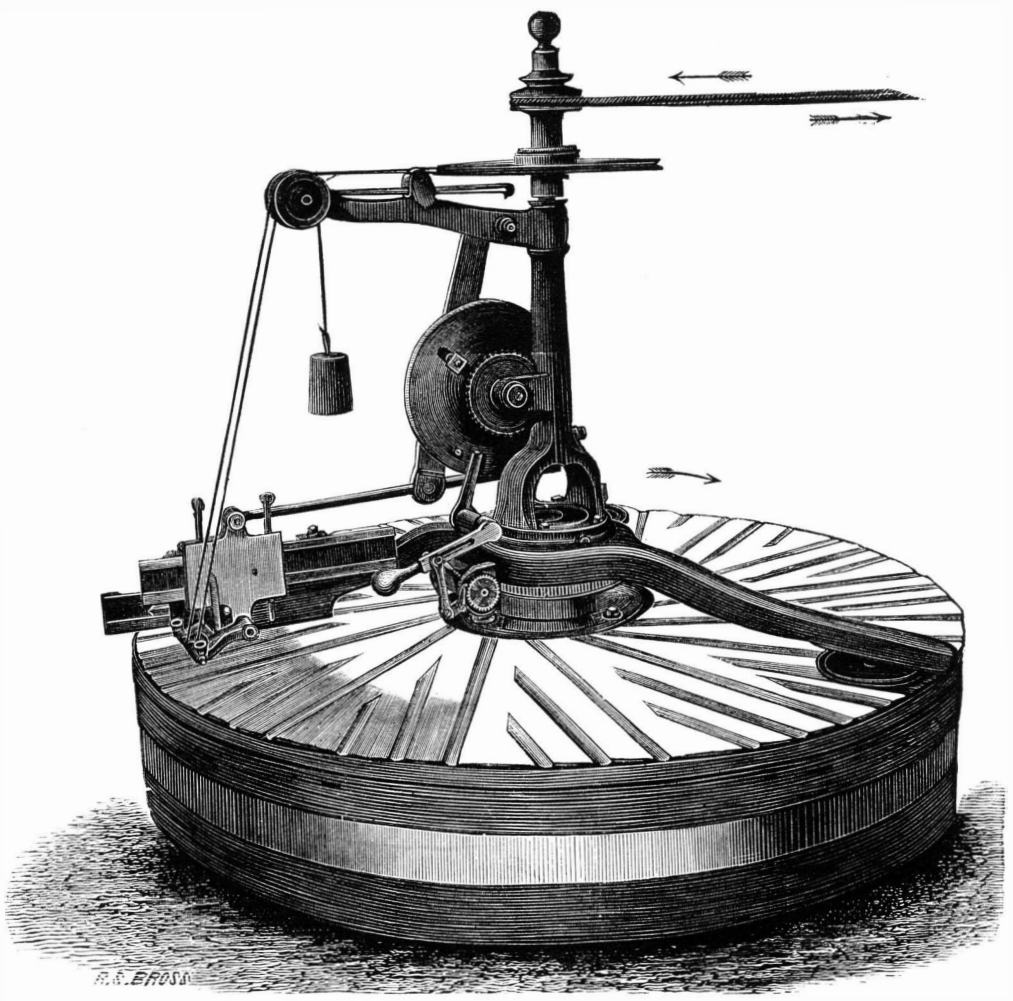
NEW ROTARY DIAMOND MILLSTONE DRESSER.

We illustrate in the annexed engraving a new application of the black diamond, or carbon, to the dressing of millstones. The device is the invention of M. A. Millot, of Zurich, Switzerland, and may be applied to millstones of any size and nature. The cutting is done by a rotary head to which the diamonds are attached.

The machine works entirely automatically, the mechanism being attached to a solid base, which is secured to the center of the stone. The rotating cutter moves forward and back; and when it has completed its travel in one direction, a ratchet wheel advances one tooth, and the machine operates so as to present a new surface of the stone to the action of the diamonds. The cutter head revolves at the rate of 12,000 turns per minute without the slightest vibration. The diamond points work in oil, and the adjustment is such that they always fall into the old series previously cut. But very little power is required, and a simple cord serves for its transmission. In less than an hour, it is stated, an ordinary stone is dressed with an accuracy never before attained. The edges are disposed to any desired eccentricity, in order that the increase may take place under the most favorable conditions, and so as to overcome the centrifugal force corresponding to the diameter of the stone.

M. Millot states that the automatic action of his machine is an advantage more than sufficient to compensate for its cutting only in radial direction. Waste of diamonds is prevented by completely imbedding the stones in the cutter head, so that these points never project beyond their metallic holder.

In one of the largest mills in Zurich there are eight pair of stones, four of which turn to the right and four to the left. No difference whatever is noted between the two sets in point of product obtained. In order to test the durability of stones cut by the machine with those dressed by hand, two pairs were prepared, one in each way, and worked for eight days. At the end of this time the hand-dressed millstone was considerably worn while that dressed by the machine was unaltered. It was also noted that the diamond-dressed stones remained more perfect at the circumference. One diamond cutter, it is further stated, will serve to dress several hundred stones.



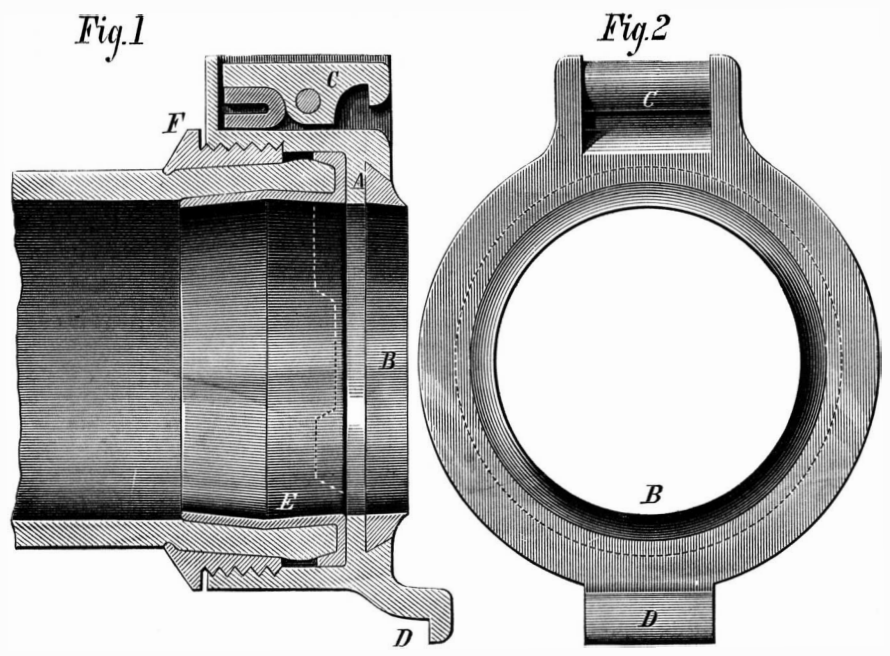
MILLOT'S ROTARY MILLSTONE DRESSER.

PRICE'S IMPROVED HOSE COUPLING.

The annexed illustration represents a new hose coupling which offers the advantages of easy connection by simple automatic catch mechanism, and which embodies a novel way of securing the hose, so that the latter is held with great firmness. At the same time means are provided whereby the hose can be quickly released from the coupling. Fig. 1 is a sectional view, and Fig. 2 an end view, from which it will be understood that the two parts of the coupling are precisely alike, and are interchangeable: so that, if one portion should become injured, another may be readily substituted, and thus the failure of one part does not necessitate the removal of the entire union.

A is the main ring. In a recess on its front side is secured rubber packing, B. Pivoted in its upper portion is a catch, C, which bears against a bent rubber spring as shown. Cast on the corresponding lower part of ring, A, is a projection, D. As the opposite half of the union is made in similar manner, it will readily be seen that the projection, D, on one half enters under the hook of catch, C, on the other, and is engaged thereby, and *vice versâ*. Hence it is only necessary to bring the faces of the parts together, when the catches become fastened; and the packing, B, being compressed, effectually closes the joint.

The principal difficulty encountered in devices of this description is the fastening of the hose in the rings, so that it cannot be pulled out or forced out by heavy pressure. In the present invention, a flanged double-conical ring, E, is slipped on the hose, so that the edge of the latter is lapped by the flange while the conical portion passes inside. Over ring, E, the main coupling, as already described, is placed. Then a threaded ring, F, enters the threaded rear part of ring, A, takes against the hose, and jams it firmly against the tapered ring, as represented.



PRICE'S HOSE COUPLING.

Patented through the Scientific American Patent Agency, April 18, 1876. For further particulars, relative to sale of rights or of patent, address, before January 1 next, George W. Price, Smithtown Branch, Suffolk county, N. Y., or J. A. O'Brine, northwest corner of Front and Pine streets, Philadelphia, Pa.

The Companion of Procyon.

It now seems probably that M. Struve was mistaken in his supposed discovery, made some time ago, of a companion star to Procyon. The astronomers at the Washington Observatory have been unable to detect any such star, even with the great telescope. M. Struve is repeating his observations; but as he has since noted companion stars to Regulus and Arcturus in the shape of fine spots of light, distant about 10 seconds, where it is certain that no heavenly bodies of the kind are in existence, it appears that the optical deficiencies of the astronomer himself have led him into error.

Chinese Views on English Science.

If the election were not over, we should direct the attention of our political contemporaries, whose ingenuity is so fertile in devising campaign anecdotes not wholly complimentary to their opponents, to the author of a book called "Ki-king-lu," who seems to possess a special aptitude for that species of literary work. The volume is published in China; and the author, who has resided in England, returns home and accounts for British scientific progress by the fact that the English have undoubtedly robbed the Chinese of their learning. One method adopted by English scientists has been the making of an extract from the eyes of Chinese who have become Christians, and touching the eyes of foreigners withit, by which they have been enabled to understand astronomy and perceive the mineral wealth of the earth. This clearly accounts for Professor Proctor's remarkably rapid mastery of the science of the stars. Another valuable medicine for the promotion of intelligence has had, for one of its ingredients, the brains of a Chinese girl who had embraced Christianity. Other medicines have been mixed with the brains, and the compound made up into pills, which received their final touch in the shape of incantations instead of sugar coating.

Our English readers will perhaps identify the author of this remarkable book from his statement that he lived three years in England, during which time he had three princesses given him to wife by Queen Victoria, and that he was only permitted to return to China upon giving a promise not to expose the British improprieties which he had witnessed.

A Curious Grain-Drying Process.

A correspondent of the Chicago *Inter-Ocean* describes a new process for drying grain, which he states is now in successful use in St. Louis and other cities, and by which grain, in any condition short of actual decay, can be restored to a merchantable grade and rendered safe to ship to any part of the world. The machinery consists of two conical-shaped revolving cylinders, the inner one being heated by confined steam, and the outer one fitted with appliances by which the grain is carried up and dropped through several feet of heated space upon the hot smaller cylinder. The cylinders being of conical shape, a draft is created, and the damp and impure vapor arising from the grain is carried off at the larger end of the curer in stifling clouds. Upon both cylinders electro-magnetic metals are attached in such manner as to generate a constant current of electricity, which is said to act upon the grain in some such manner as electricity acts upon the human skin. The grain becomes electrically excited. The result of the process upon grain is scarcely less than wonderful. Corn, wheat, and oats, in such wretched condition when they went into the machine that no one would ever think of doing anything with them but throw them away, came out entirely dry and thoroughly cleansed of mold.

[The foregoing may relate to some new process, but the description is evidently absurd. There are no "electro-magnetic metals," and we cannot perceive wherein "electricity" could, under the circumstances, exercise any effect, beneficial or otherwise, on the grain. Possibly some one can send us definite information regarding the process to which the writer refers.—EDS.]

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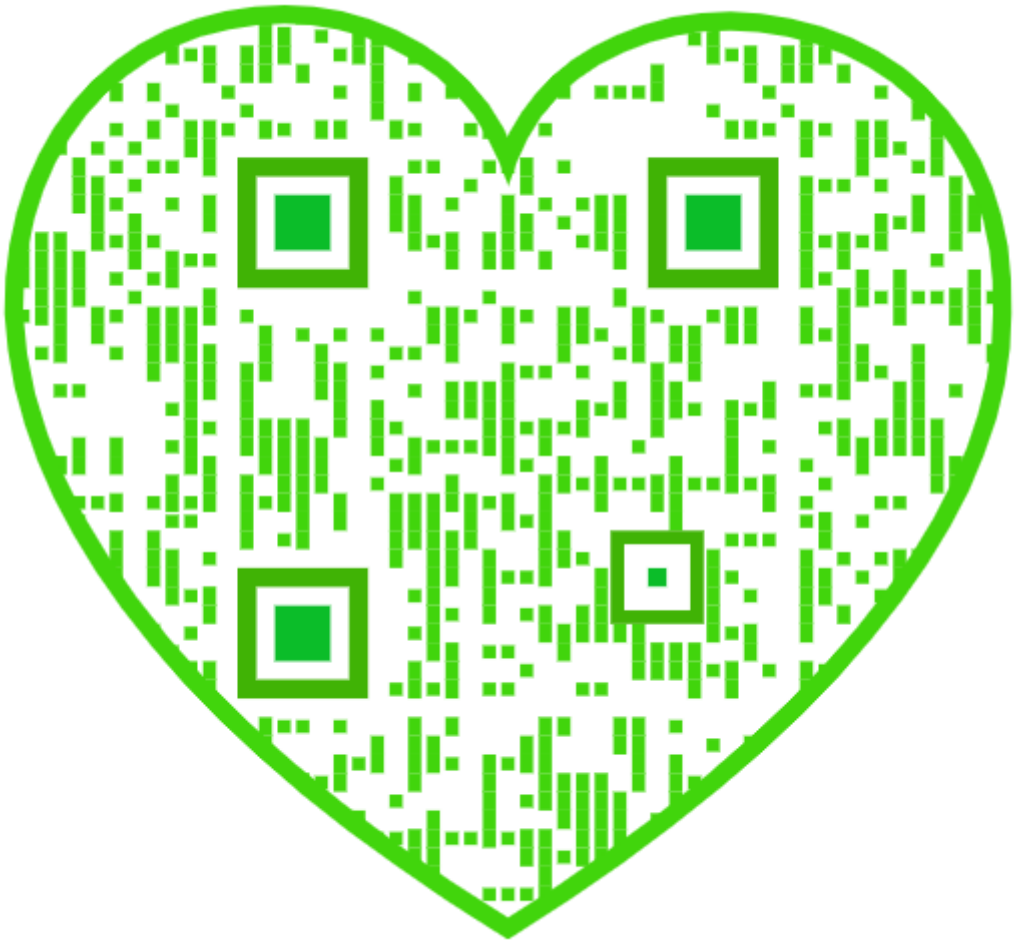

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THE EXTENSION OF SENSE.

In "What the Coming Man may be" we considered, not long ago, some of the possibilities of humanity in respect to the development of man's moral and intellectual faculties; and seeing, with the hero of Locksley Hall, that the thoughts of men are widened with the process of the suns, we looked forward to a time when faculties such as Shakespeare, Newton, Mozart, Michael Angelo, and other men of great genius enjoyed shall be the common inheritance of the race: a time when the average man shall as far surpass the highest men of today in moral and intellectual force as the latter do the lowest savages or the most brutal of our prehistoric ancestors.

In his suggestive address before the American Chemical Society, Dr. Draper touched another aspect of the question, the extension of man's faculties of sense. Referring to the two well known classes of nervous fibers—those which gather the impressions of external things and convey them to the nerve centers, and those which transmit the dictates of the will from within outwards—he observed that, in the improvement of the capabilities of one of the former by telescopes, microscopes, and other sight-aiding contrivances, we have an earnest of what may hereafter be done as respects the four other special organs of sense: while as concerns the second class, the increase of man's power is not less remarkable. The resolves of the will may already be transmitted beyond us with even a greater velocity than in the living system itself, and that across vast terrestrial distances and beneath the sea. "Telegraphic wires are, strictly speaking, continuations of the centrifugal nerves, and we are not without reason for believing that it is the same influence which is active in both cases."

The learned lecturer might have added that the extension of sight by no means exhausts the improvements of special sense already arrived at. In range and delicacy of action, the aural apparatus of the skilled musician surpasses that of the savage even more than his visual organs do: while the extension of sight by means of lenses is all but paralleled in hearing by means of modern acoustic apparatus. Already we may here by telegraph the intonation of a speaker, or the notes of an instrument, many miles away; the entanglements of sound are analyzed by the inventions of Helmholtz as completely as those of light are by means of the prism; while by Kœnig's apparatus the eye is constrained to do the work of the ear, sounds inaudible by the ear are, so to speak, heard by the eye, and the range of human knowledge and capacity for investigating Nature, are thereby vastly extended.

In a scientific point of view, Dr. Draper goes on to say, such improvements in the capabilities of the organs for receiving external impressions, such extensions of the distances to which the results of intellectual acts and the dictates of the will may be conveyed, constitute a true development, an evolution none the less real though it may be of an artificial kind. "If we reflect carefully on these things," he adds, "bearing in mind what is now known of the course of development in the animal series, we shall not fail to remark what a singular interest gathers round these artificial developments—artificial they can scarcely be called, since they themselves have arisen interiorly. They are the results of intellectual acts. Man has been developing himself. He, [so far as the earth is concerned, is becoming omnipresent. The electrical nerves of society are spread to a plexus all over Europe and America: their commissural strands run under the Atlantic and Pacific."

When shall this line of development have an end? In his reach of sense-perception, his mastery of time and space, his ability to foresee and control the course of Nature, making the powers of earth and air to serve him and do his bidding, the man of today surpasses the gods of yesterday. Who shall say what the man of tomorrow may not be?

It is high time to cease canting about the degeneracy of of man in these latter days. Those who spend their lives among the dreams of the ancients, knowing nothing of the powers and achievements of modern man, may be pardoned for proclaiming their own inferiority; but they have no call to speak for the real men of the real world about them, the men who are doing the world's work, at the same time steadily lifting humanity to higher and yet higher planes of capacity and power.

In spite of those who persist in facing backwards, denying that scientific progress is any measure of human evolution, the progressive development of human force and faculty is a reality. Where the ancient athlete could strike a blow of a hundred pounds, the modern mechanic can deal one of as many tuns; the steam hammer, the rifled cannon, the rock-rending dynamite being as truly human as the muscle on his shoulder. In creating them, man has added to his personal power as truly as if he had increased by so much the forces of his right arm. The telescope, the microscope, and the spectroscope are extensions of his eye. The resonator, the manometric cell, and the electric sounder are additional ears. The electric telegraph enables him to be and to act in a thousand places at once. Indeed all that science and art have done to make man master of the conditions and forces of Nature may be considered so many extensions of his organic endowments.

Yet, much as has been accomplished in this direction, much as the civilized man excels the savage in scope and reach of faculty and force, the scientific development of human capabilities has but just begun. As Dr. Draper happily expresses it, we have in what has been done merely an earnest of what the future has in store. In the direction of taste and smell, the Universe is almost entirely unexplored. Properly disciplined and aided by mechanical and other means of increasing their range and acuteness, these senses may prove as efficient in the exploration of Nature, as serviceable for the mental and material advancement of humanity, as either sight or hearing. Already we have an intimation of what discipline may do for the sense of touch in the exquisite tactile sensibility of some blind people, in the extreme sensitiveness of the bat's wing and the antennæ of insects; and even greater promise is held out by taste and smell as exhibited in the chemist's ability to distinguish thereby many sapid or odorous substances, in quantity too small to be otherwise detected. Still more strikingly are the possibilities of these senses manifested in certain nervous states produced by drugs or disease, especially that condition of exalted sensibility known as hyperæsthesia. And it is quite possible that, as the microscope, acting externally, increases the natural acuteness of vision, so the range and acuteness of the senses excited by contact may be correspondingly increased by substances acting interiorly through the nervous system.

It is true that such exaltations of sense-perception are apt to be attended with mental disturbances more or less disqualifying the subject for logical thinking; but we cannot pronounce it impossible for chemistry to discover or produce compounds capable of bringing about the one state unattended by the other: in other words, capable of heightening in any desired degree the acuteness of any sense without deranging at the same time the proper balance of the purely mental faculties. Besides, a telescope or a microscope in the hands of an untrained savage is quite as puzzling in its action, as confusing in its results, as the direct testimony of our senses is under hyperæsthesia. And it seems not less reasonable to suppose that the mind may learn to adjust itself to the new conditions of perception as readily in the one case as in the other. In either event—the discovery of other means of exalting sense, or the education of the mind to act normally under such new conditions—an enormous extension of human faculty must result; and the coming man may find therein the means of surpassing us, as signally as we do the most brutish of barbarians, in our power of penetrating the secrets of Nature and turning them to our advantage.

THE GREAT CYCLONE IN BENGAL.

If the disasters which have overtaken the unfortunate inhabitants of Bengal, India, had occurred in ancient times, we should now possess traditions of punishments inflicted by an offended deity, besides which the legends of the Flood, Sodom and Gomorrah, and the Egyptian plagues would be altogether inconsiderable. The population of the province is now as numerous as that of the United States. Through the failure of the rice crop in 1878, owing to protracted droughts, a famine occurred which killed off the people by the hundred thousand, and the deaths would undoubtedly have reached millions had not the British Government exerted itself to send immense quantities of food among the starving cultivators of the land. Now comes one of the most terrible hurricanes ever experienced in that land of typhoons and fierce storm; and official reports tell us that over 250,000 people have fallen victims to the three great

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storm waves which have submerged the country for over 3,000 square miles.

The cyclone, which occurred on October 31 last, arose in the Bay of Bengal, and took a northward course, wrecking several large vessels which lay in its track. It just missed Calcutta, but struck Chittagong, which lies in the most northeasterly corner of the bay, stranding every vessel in the harbor and nearly destroying the town. Meanwhile the storm waves submerged the great islands of Hattiah, Sundeep, and Dakhin, lying in one of the mouths of the Ganges, covered several smaller islands, and then flowed over the land for five or six miles toward the interior.

It appears that the immense waves were projected with astonishing velocity. Up to 11 o'clock on the night of October 31, Calcutta despatches reporting the storm said that no especial danger was anticipated, but before midnight the waters had overrun the land to a depth of 20 feet.

An examination of the map shows that the islands mentioned are situated near an estuary of the river Megna, and they owe their origin to the deposition of soil washed down by the Ganges. They constitute part of the Sunderbunds, as the low, marshy land thus produced is called, from its being covered with the "sunder" tree; and the district is not only the hottest but probably the most unhealthy portion of British India. Malaria reigns everywhere, and the forests and jungles abound with tigers and other ferocious beasts. The English Government for some time past has labored to reclaim the islands, and has offered strong inducements to settlers to cultivate the ground, which is rich and extremely fertile. These efforts have resulted in the clearing of a large portion of the territory, and the raising thereon of valuable crops of cotton, rice, sugar cane, mulberry trees for silkworm food, and timber: while the population of Dakhin, the largest island of about 800 miles in extent, has increased to 240,000, and those of Hattiah and Sundeep together number some 100,000 inhabitants.

Of course the devastation in this district has been complete. The country is dead flat; and the people, when the wave burst upon them, had no place of safety but in the tree tops. And there such as were able found their way, sharing their refuges with the wild beasts, birds, and serpents. Houses by the thousand were utterly swept out of existence, and the only relics of human habitations afterwards found, were cast up on the Chittagong shore, ten miles distant.

The Calcutta *Government Gazette* says that, "wherever the storm wave passed, it is believed that not a third of the population survived. The islands have barely one fourth of their former inhabitants." All the cattle were destroyed, and the stench of the decomposing remains has already generated an outbreak of cholera which it is feared will prove general. The British Government is taking steps to relieve the distress which prevails.

AN INDIAN DUST STORM.

In his clever account of Bannu, a district in the Punjaub, Thorburn describes a dust storm on the great plain of Marwat, a phenomenon of such imposing force and grandeur as to be well deserving of the important position lately accorded it, by American scholars, among the great geological agents.

Marwat, the bed of an ancient lake, is now a vast treeless plain of undulating, sandy down, bordered by a region of soft loamy clay, deeply furrowed by watercourses, and overlaid by a layer of gravel and smooth, rounded stones, called "hell stones" by the people, because of their black and scorched appearance, the effect, probably, of natural sand blast attrition. Seen in autumn or in a year of drought, it appears a bleak, howling wilderness, fit home for the whistling, heat-laden dust storms that often sweep across its surface in the hot months; but in late spring, after a few timely showers, it presents an interminable sea of wheat, the vivid green of which gives place here and there to streaks and patches of darker shaded grain.

The approach of a dust storm over this place in the dry season, and witnessed from one of its boundary hills, is a grand and impressive sight. At first but a speck on the distant horizon, it rapidly elongates until it stretches from east to west, a mighty, threatening wall a thousand feet high and thirty miles in length. Nearer and nearer it comes, phantom-like, its rushing noise being inaudible to the spectator. Now one wing is pushed forward, now another, nearer still: and now the birds—kites, vultures, and a stray eagle or two—circling its front are visible, and one by one the villages at the foot of the hill are enveloped and hidden from the eye: a few minutes more and the summit of Shekhbudin, till then bathed in sunshine and sleeping in the sultry stillness of the June morning is shrouded in yellow, scudding clouds. Vanished is the grandeur of the scene in a moment, and nought remains but the stifling, begriming dust, flying and eddying about in all directions, penetrating everywhere. Outside nothing can be seen but a darkness which can be felt, and nothing is audible but the whistling of the wind and the flapping of bungalow chicks: but inside the lamps are lighted, and a quarter of an hour is idly passed, until the storm, which generally expends its fury on the hillsides, subsides or passes on.

LOW FLYING BALLOONS.

In his very excellent report, recently made, on the progress of aeronautics, to the British Aeronautical Society, of which he is secretary, Mr. Francis W. Brearey says:

"It is singular that no one has taken advantage of an ascertained fact to put the balloon to more pleasurable, because more prolonged, use than has hitherto been attempted." After instancing how a boat may be caused to travel with the current of a stream by simply using a pole to push it clear of the banks, he adds: "There is every probability that, with a balloon so balanced, a push with a long pole would send it up spinning for fifty feet or more, and one might traverse a few hundred yards before it neared the earth and required another push."

Shortly before undertaking the ascension in which he lost his life, Mr. Donaldson, the well known aeronaut, described to us his experience in just such balloon sailing. He stated it as his belief that, if ever the time came when people would step into balloons as readily as they now do into railroad cars, the air ships would not sail above the clouds, but would skim close along the surface of the ground. He gave many reasons for this view—notably increased safety and economy, since balloons could be made much smaller, as they would not require a large amount of gas to keep them afloat, and there would be little difficulty in stopping to replenish the supply when exhausted. He had found no trouble in balancing a balloon at four feet above the ground, and at keeping it accurately at that hight for hours. He told us, further, that he frequently traveled along country roads in this way during calm weather, using a pole to push himself along when there was no wind, or to guide himself when being wafted by a breeze. As an instance of how exactly a balloon can be balanced, he stated that, while thus sailing over a road, he carelessly dropped overboard about a quarter of a loaf of bread, whereupon the air ship sprang aloft a hundred feet or more. We asked him how he avoided wagons and similar obstacles in his path without discharging ballast, and so losing equilibrium? "Jump over them" was his answer. "A good strong push downwards on my guiding pole has sent me flying over many a tree in which I thought I was sure to be entangled." This flea-like mode of progression was a favorite mode he had of astonishing rustics.

Mr. Brearey's paper is published in full in SCIENTIFIC AMERICAN SUPPLEMENT, No. 50; and among other remarkable facts, it notes that a one horse power engine can be made to weigh only thirteen pounds. There are also descriptions of Moy's steam flying locomotives and others of the most nearly successful efforts toward solving the problem of aerial navigation.

THE RADIOMETER NOT A LIGHT MOTOR.

The immense quantity of evidence in the shape of experiments on the radiometer, which has been accumulated by the principal physicists of Europe, leaves no reasonable doubt but that the claim that the apparatus is driven by light is unfounded. It is maintained by our correspondent, M. Delsaulx, that the radiometer is an electrical engine; a majority of observers pronounce it simply a machine driven by heat. So long as it is decided that the radiometer is actuated by forces which are intrinsically perfectly well understood, leaving the problem merely one of determining how the same are applied, the whole subject sinks at once to secondary importance. It was only because the apparatus appeared to demonstrate the ponderability of light, and hence was an apparent serious contradiction to the undulatory theory, that it has excited the close attention of the scientific world.

Dr. Frankland's recent experiments on the radiometer are among the most conclusive that have been made, as showing the true source of its motion. The disks of his instrument were of aluminum, polished on one side and blackened on the other. They were extraordinarily sensitive, and continued rotating often for twenty minutes after the sun had descended below the horizon. Placing this radiometer in a room where the conditions were such that it remained motionless, Dr. Frankland enclosed its globe in his hands so as to cut off light from the disks. Yet they at once began to rotate, polished side in advance. On withdrawing his hands, the motor, after the lapse of two or three minutes, stopped: then after another brief interval, it resumed in the opposite direction for a short time. There was rotation set up without the aid of light, and clearly due to the temperature of the investigator's hands.

The next experiment was exactly the converse, and involved testing the apparatus under light destitute of heat. It is well known that the moon, although reflecting the sun's rays, sends but a very small amount of heat to the earth. With a lens 3 feet in diameter, concentrating the lunar rays on a thermoscopic pile, Melloni proved that the deviation of the needle was from 0° 6′ to 4° 8′, according to the phase of the moon. This indicates so extremely small a heating power that it is practically inconsiderable, and is destitute of any known effects upon the earth. Dr. Frankland therefore exposed his radiometer to bright moonlight, but it did not stir. Then, with a powerful lens, he rendered the intensity of the rays 200 times greater, and directed the brilliant image of the moon, produced at the focus, directly upon one of the disks of the radiometer. Not the slightest movement was appreciable, although the light was kept unaltered for over a quarter of an hour.

Dr. Frankland's conclusions sum up the true facts regarding the radiometer in brief terms. He says: that light is not necessary to the motion of the instrument: that light does not contribute to its motion unless (by absorption) it be transformed into heat, which did not take place (or occurred in an unappreciable degree) for moonlight: that the movement of the disks is due to the unequal heating of the two faces of each disk, the cooler face always preceding the hotter one. When the globe is taken in the hands, the blackened face of each disk absorbs heat rapidly, while the bright side reflects it. Thus the surfaces of the black disks remain hotter than the metal situated below, but soon communicate their heat to said metal. If the hands be withdrawn, the thermal conditions are reversed: the black face, being a better absorbant and at the same time a better radiator, cools much more quickly, and hence the opposite motion of the mill already described.

THE LIMITS TO PHYSICAL CULTURE.

We have frequently had occasion to dwell upon the fact that, while moderate physical culture is a great benefit, indeed a necessity, to ensure a proper balance of mental and bodily powers, and consequent health and longevity, physical overculture is a great evil, leading to results diametrically opposite to those sought to be attained. At one end of the series is a constitution weak and unfitted to resist disease or the effects of labor, on the other an organization strained to its utmost and ready to yield under the slightest addition to the stress. Obviously between these extremes there must be a mean up to which all culture is beneficial, and beyond which all is overculture. The question is, however, whether that mean is in the nature of a personal equation for every one, differing for each individual constitution, or whether it is possible to formulate general laws, true for all systems. The tendency of modern investigation, in all cases relating to the science of life and of living, is favorable to the latter view. Mr. Charles Darwin sends out his formulated questions the world over, and deduces results from the replies proportionally considered. Candolles does the same in his elaborate investigations into the antecedents of scientific men; the statistics relative to the recruits for our army we have shown, in recent articles, to admit of valuable deductions relative to our national characteristics; and we might add numerous examples, all showing that that which is proved true, on the average, for a large number of persons, may with reason be assumed to be true of an entire class, or even a race, when surrounded by generally similar conditions of life.

Now in the case of physical culture, the point specially to be determined by actual physiological investigation is to what extent the body may be benefited. This known, any one may easily discover for himself when the limit is reached, and will understand that to carry his training still further is a positive disadvantage and injury. Such an investigation has lately been made by Dr. Burcq of Paris, in the *Ecole de la Faisanderie*, a gymnasium where are drilled the soldiers who are destined to be the gymnastic instructors of the French army. No better set of men could be selected for examination, for the reason that each individual is virtually intended hereafter to serve as a model for others, and therefore his physical culture is brought to the best possible state. Dr. Burcq continued his investigations with the utmost care and minuteness, for six months, during which period the progress of over a thousand men was closely watched and criticized. As a general result, he tells us now that gymnastic exercises:

1. Increase the muscular forces up to 25 and even up to 38 per cent, at the same time tending to equilibrate them in the two halves of the body.

2. Increase the pulmonary capacity at least one sixth.

3. Increase the weight of men up to 15 per cent, while on the other hand diminishing the volume. This augmentation exclusively benefits the muscular system, as is demonstrated by its elevated dynamometric value.

And Dr. Burcq further observes that, during the first half of the six months' course at the school, the increase of force was most markedly noted.

To Dr. Burcq's admirable studies upon this body of trained gymnasts may be added those of M. Eugene Paz, who for a long period has been observing the results which methodical physical exercise produces in certain invalids and in a large number of people of various callings, notably artists, literary and business men, and others whose muscles are normally less voluminous than those of the picked soldiers at the *Faisanderie* School.

By means of a variety of ingenious mechanical apparatus, and by a course of investigation wholly different from that of Dr. Burcq, M. Paz reaches precisely the same results. He notes especially the increase in weight and decrease of volume of the body, above referred to, and also the augmentation of pulmonary capacity. Three operatic singers who were rigorously trained for a year attained a maximum lung power corresponding exactly to an increase of one sixth. It follows, therefore, that Dr. Burcq's results may be considered in the light of a general law, and likewise as a guide to what is correct physical culture. In this view, we commend them to the attention of college authorities and students.

English Views of our Silk Industry.

At a meeting of silk weavers at Macclesfield, England, the headquarters of British silk manufacture, considerable dissatisfaction was expressed that no steps had been taken to exhibit English silks at the Centennial, the speaker stating that, were the United States once made aware of the excellence of the goods, the 60 per cent duty on them, imposed by our laws, would probably soon be removed. The Centennial correspondent of the *Macclesfield Courier*, himself an expert in silk, denounces their expressions as "false and foolish." After mentioning that the reduction in cost of labor is fast removing the chief obstacle with which American manufacturers have to contend, he says to his countrymen: "We shall find that the ample labor saving appliances and greater intelligence of the work people will bring us face to face with a competition such as we have never yet dreamed of, and I venture to say that before long England, mother of free trade as she is, will find herself compelled to impose a duty on the importation of American silks, in order to protect her manufacturers from being beaten in their own markets."

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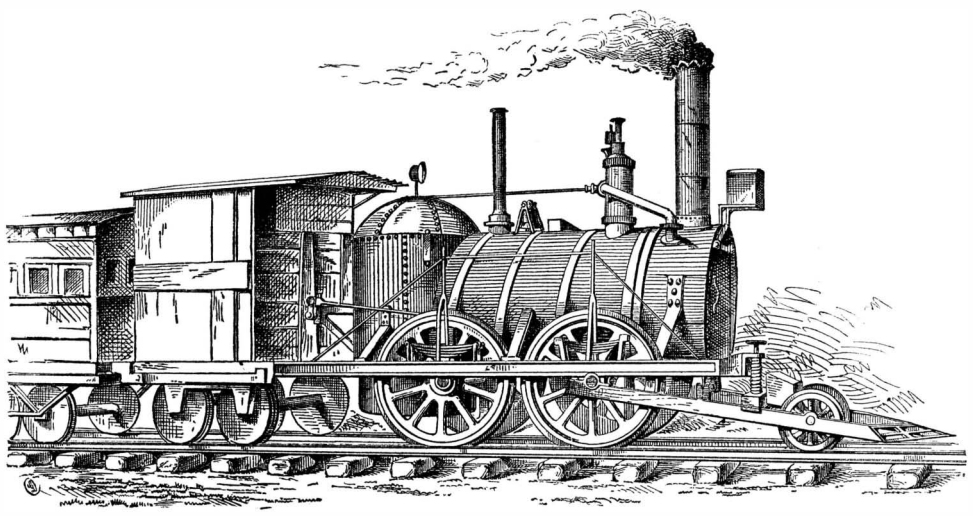
THE "JOHN BULL" LOCOMOTIVE AT THE CENTENNIAL.

The annexed engraving represents a curious old relic of early railroading in this country, which attracted considerable attention during its exhibition at the Centennial. It is the locomotive "John Bull," built by George and Robert Stephenson, at Newcastle-on-Tyne, England, for the Camden and Amboy Transportation Company, and shipped to Philadelphia in 1831. From Philadelphia the machine was carried in a sloop to Bordentown, N. J., and, being packed in wagons, was hauled out to the only piece of permanent track of the Camden and Amboy company then completed, a line about ¾ of a mile in length, and situated about 1 mile from Bordentown. The machinery was put together on the track, and a tender was constructed from a whisky hogshead placed on a small platform car which had been used by the contractor in building the road. The connection between the pump of the locomotive and the tank was made by means of leather hose fitted up by a Bordentown shoemaker.

Steam was first raised in the boiler on September 15, 1831, and after several trial trips the first public exhibition took place on November 12. R. L. Stevens acted as conductor and general director, and the entire New Jersey legislature were present as witnesses. The "John Bull" remained in Bordentown until 1833, and was occasionally used elsewhere until as late as 1866. The cylinders are 9 x 20 inches, and the driving wheels 4 feet 6 inches in diameter, with hubs of cast and tires of wrought iron. The entire weight of the locomotive is 10 tuns.

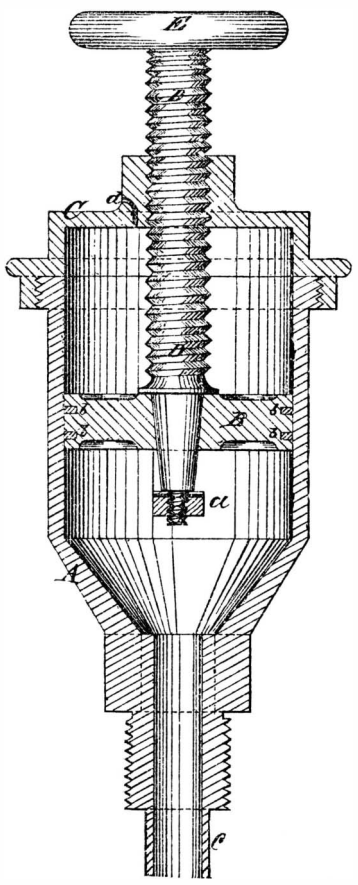
With the old machine was exhibited a portion of the original track above mentioned. The rails were rolled in England, and were supported on stone blocks prepared at great expense, wooden ties not being deemed safe.



THE "JOHN BULL" LOCOMOTIVE.

IMPROVED LUBRICATOR.

Mr. George C. Johnson, of Portland, Me., has patented through the Scientific American Patent Agency, September 26, 1876, an improvement in lubricators, by means of which a dense lubricating compound can be forced into journal boxes. A, in the annexed engraving, is a cylinder of brass, bored to receive the piston, B. A cap, C, is screwed to the top of the cylinder, A, and D a screw provided with the hand wheel, E, and fitting a screw thread cut in the center of the cap. The lower end of the screw is made conical, to fit a seat in the center of the piston.



The conical part of the screw is longer than the thickness of the piston, projects a short distance below, and is provided with a nut and washer, *a*, to prevent the piston from leaving it. Grooves, *b*, are cut in the piston to receive packing rings.

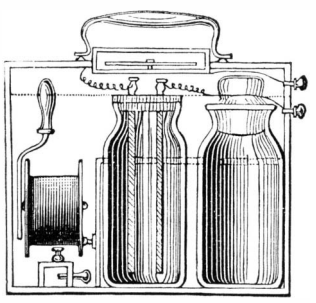
The lower end of the cylinder, A, is made conical or funnel-shaped, and is provided with a threaded tube, *c*, which screws into the journal box. An aperture, *d*, is made in the cap for the admission of air. The cylinder, A, is filled by removing the cap and piston, and the lubricant is forced into the journal box, through the tube, *c*, by forcing down the piston, by means of the screw. Should the journal heat, the lubricator becomes warm, melting the lubricant, allowing the piston to drop to the nut, *a*, leaving a space between it and the conical part of the screw, through which air may pass.

GALVANOMETER FOR TESTING LIGHTNING CONDUCTORS.

The preliminaries necessary to testing lightning conductors are often troublesome, the apparatus required for it being rarely obtainable in handy and convenient form, though, indeed, little apparatus is required: merely a galvanic element, a galvanometer, and a sufficient quantity of insulated copper wire. The firm of Mittelstrass Gebrüder, in Magdeburg, Germany, have recently combined the essential parts in a galvanometer chest, the arrangement of which (described in a recent number of Dingler's *Polytechnisches Journal*) is as follows: In front, the lid is fastened with two hooks. At the side are two binding screws for attachment of copper wires. On the top is a sensitive galvanometer, the needle of which can be arrested with a screw. In the interior of the chest stand two glasses (see engraving) with equal width of neck, so that the glass stopper in one may may be readily transferred to the other, so as to close it. In the one glass is a suitable solution of bichromate of potash; in the other is the carbon and zinc element, from which spirals of wire proceed to the binding screws as indicated. It is easy to lift the element out of the empty glass into the one filled with liquid, and so produce a current. In the third division of the chest is a roller with silk-covered copper wire, which can be easily wound off, and, with the aid of a small handle, wound on again. Lastly, a binding screw serves for connecting the line to the wire rope of the lightning conductor.

Where desirable, the arrangement is so completed that only one turn of the conducting wire round the galvanometer needle is inserted, or all the turns, which can be done in a moment by turning a binding eye on the upper side of the chest. Lastly, on the under side of the lid may be introduced two resistance coils of one to ten Siemens' units, which, again, may be similarly inserted or excluded.

In testing a lightning conductor, the process is as follows: 1. The wire is unwound from the roller, drawn up to the roof, and the end of it wound about the point of the conductor. 2. The chest is opened, the element lifted over into the salt solution, the chest closed again, and so placed that the needle is still; then the binding screw of the roller is connected with that of the chest with a piece of wire. 3. By means of the small binding screw in the bottom of the chest, a wire is connected with the lower part of the wire rope of the lightning conductor, and is brought to the second binding screw of the chest. If there be perfect electric connection between the upper point of the conductor and the lower parts, the needle will be deflected. Should the deflection not occur, the place of interruption is sought for by connecting the lower binding screw with the wire at successively higher points. 4. For investigation of the earth conduction, the point of the lightning conductor is excluded, by detaching the wire and connecting it with a neighboring gas chandelier, an iron spring, or an iron rod forced deep into the ground, and then the circuit is completed as before. The deflection of the needle will be greater, the more perfect the earth conductor. Important advantage is here derived from the above mentioned arrangements for insertion of the resistance coils, or only one or the whole of the galvanic windings. After use, the element is lifted back out of the solution into the empty glass, and the galvanometer needle again arrested.



How Psycho is Worked.

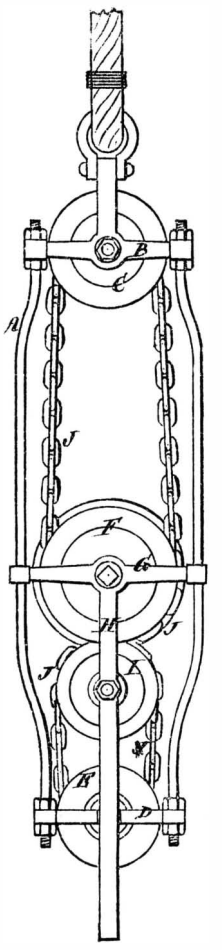
It will be remembered that not long ago we illustrated Messrs. Maskelyne and Cooke's famous automaton Psycho, which has been exhibited in London, and which has puzzled every one who has attempted to explain its interior mechanism. The figure is seated, cross-legged, on a cushion which is supported by a hollow clear glass cylinder, so as to show that no mechanical apparatus connects the automaton with the space beneath the stage or platform where a manipulator might be concealed. It has often been conjectured that the motive power was compressed air forced up through the cylinder, and this connection was strengthened when a prying Yankee, in one of Mr. Maskelyne's audiences, requested to be allowed to place a newspaper beneath the lower end of the tube, which request the exhibitor refused. Subsequently, however, the compressed air adherents were thrown into confusion by Maskelyne withdrawing his refusal and allowing the insertion of the newspaper. Now the London *Spiritualist* returns to the charge, with the same theory advanced in a new way. Psycho, its says, "is worked by varying the pressure of the air inside the glass cylinder on which the automaton stands; the compression of the air acts like a push, and the partial exhaustion of the air acts like a pull. The pushing and pulling action of this invisible rod—for committee men are not like provincial pigs, able to see the wind—the push and pull of this rod, we say, starts and stops clockwork machinery at the proper moment inside the automaton. The air enters and leaves the glass cylinder through the green baize or other fabric on which the cylinder stands, portions of the air channel being concealed under the baize. There are two ways of working the figure. In the one case, the pedestal may be directly connected with the air pump apparatus by means of a pipe passing through the stage. In the other case, the figure may stand upon a pedestal connected with no pipe. Compressed air is then contained in a metallic vessel inside the pedestal, and its escape is permitted or stopped at will by means of an electro-magnetic valve. To work this valve, the feet of the pedestal are connected with fine wires running through the stage to the battery and the electrical commutator.

"Any committee men who wish to stop the working of Psycho can do so by placing a large folded newspaper over the top of the pedestal, so that air cannot be blown backwards and forwards into the bottom of the glass cylinder; but they must watch closely that Mr. Maskelyne does not punch a hole in their newspapers to let air through. Another way of stopping the working of Psycho is to mount the bottom of the glass cylinder upon three or four bungs, which anybody may take in his pocket to the Egyptian Hall. If the bottom of the cylinder is thus removed from the surface of the green baize, no blowing of air through the baize will much vary the pressure of that inside the cylinder."

The *Spiritualist* ought to be expert in matters of this kind, and therefore we look upon its opinion as semi-professional. In any event it is the most plausible elucidation of the mechanism that has yet appeared.

A NEW TACKLE.

We illustrate herewith a novel apparatus for setting up ships' rigging, which may also be applied to any purpose where heavy weights are to be moved over small distances. It was patented October 3, 1876, through the Scientific American Patent Agency, by Mr. Thomas F. Hall, of Omaha, Neb. A are two guide rods, the upper ends of which are connected by bars, B, to and between which is pivoted a pulley, C. The lower ends of the rods, A, are connected by bars, D, to and between which is pivoted a pulley, E, the pulleys, C and E, being thus always kept at the same distance apart. F is a double chain pulley, the two parts of which are of different diameters. The double pulley, F, is arranged between the crossbars of the frame, G, at the ends of which are arranged the rods, A, which are capable of sliding up and down through the frame. Between the bars, H, are pivoted pulleys, I, at such distance from double pulley, F, that the chain, J, can pass between them freely. J is an endless chain which passes over the pulley, C, and the parts pass down upon the opposite sides of the double pulley, F, one part passing along the groove of the part of said pulley of greatest diameter, and the other part passing along the groove of the part of the pulley of smallest diameter. The parts of the chain, J, pass or cross each other between the pulleys, F and I, pass down upon the opposite sides of said pulleys, I, and around the pulley, E. The power is applied to the shaft of the double pulley, F. The crossbars or frame, B, is connected with the rigging or weight, and the end of the frame, H, is connected with the side of the vessel or support. As the pulley, F, is turned in one direction, it moves slowly up the chain, J, toward the pulley, C, drawing the frames, G H, toward the bars or frame, B, slowly, but with immense power, the pulleys, C E, keeping the chain, J, always taut, and the pulleys, I, holding the said chain in place upon the pulley, F.



Smoky Stoves.

There is a very simple way of avoiding the disagreeable smoke and gas which always pours into the room when a fire is lit in a stove, heater, or fire place, on a damp day. Put in the wood and coal as usual; but before lighting them, ignite a handful of paper or shavings placed on the top of the coal. This produces a current of hot air in the chimney, which draws up the smoke and gas at once. Not one person out of fifty ever thinks of this easy expedient.

IRON is a dangerous ingredient in fire brick. When a brick containing iron is exposed, even at a low temperature, to gases containing carbon, part of the carbon is deposited near the iron. This has often not only caused the brick to lose its cohesion, but may even burst it so as to throw down the iron walls of furnaces and the linings of flues.

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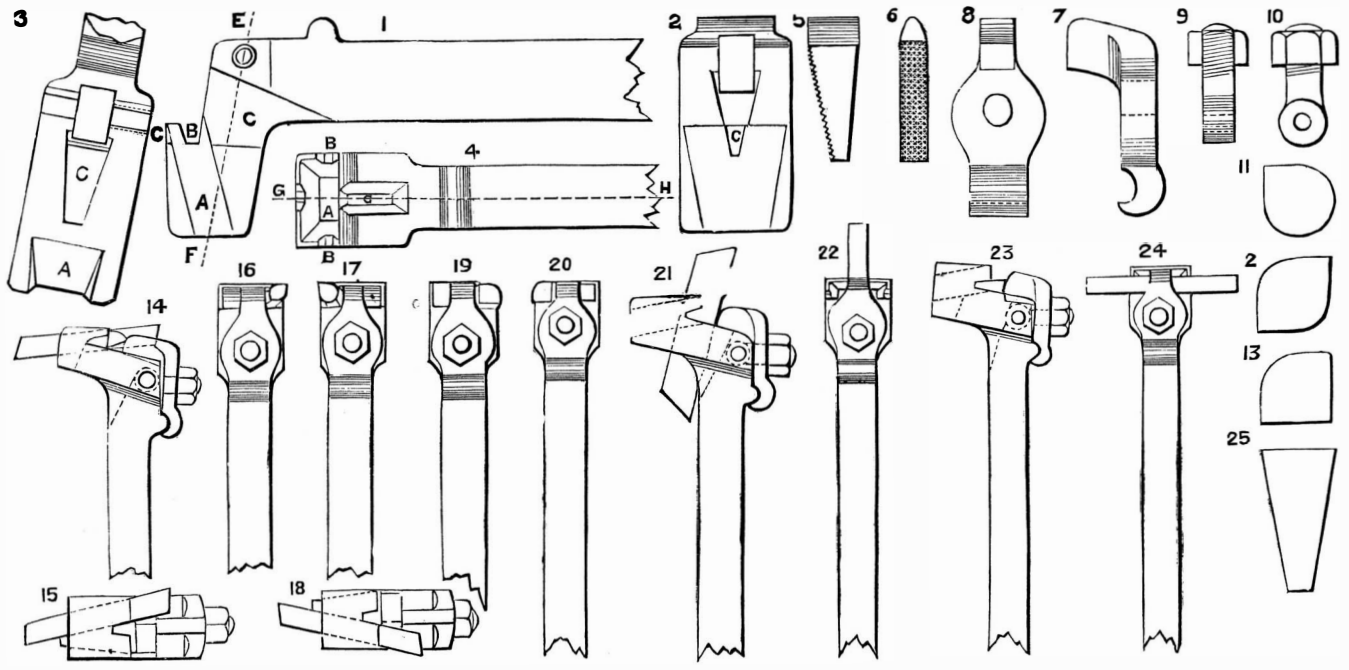
IMPROVED TOOL HOLDERS AND CUTTERS.

The forms of tool holders and cutting tools shown in the annexed illustration are the subject of a patent to Messrs. New and Matthews, of Nottingham, England, and Mr. W. H. Berry, of the same place. They speak for themselves, says the *English Mechanic*, and require but little description, The tool holder is adapted for holding securely in a rectangular tapered slot a right hand or left hand cutting tool at suitable and fixed cutting angles (such tools being secured firmly by a serrated wedge and clamps held down by a swivel bolt and nut), also for holding in suitable tapered slots a straight tool and a cross tool cutting on either side at right angles. These tools are secured firmly by clamps held down by swivel bolt and nut. This holder is adapted for using the patentees' special sections or round or square steel. The invention further consists of three special sections of steel, and may be made to any size required. These sections of steel can be formed into uniform, angular, or round-nosed tools for right or left hand cutting. From these special sections a variety of tools suitable for various cutting purposes can be produced, which are particularly adapted for the rectangular tapered slot in the holder. From the same uniform bar of steel, tools can be cut in suitable lengths, and then, without being forged, ground to a proper cutting angle for the several purposes required. Further, the novel shape of these special sections, when placed in the new holder, gives a positive and fixed angle for cutting.



MESSRS. NEW, MATTHEWS, & BERRY'S TOOL HOLDERS AND CUTTERS.

Fig. 1 is a side elevation of tool holder in section (on line, G H, 4). A is a rectangular tapered slot; B is a tapered slot at right angles to the lengthway of the holder; C is a tapered slot parallel with the lengthway of the holder; 2 is an elevation of the tool holder; 3 is an elevation in section (on line E F, 1), showing the tapered slot, C; 4 is a plan of tool holder, showing the rectangular tapered slot, A, and tapered slots, B B and C; 5 is a front elevation of serrated wedge, and 6 is a side elevation of it; 7 is a front elevation of clamp, and 8 is a plan of it; 9 is a front elevation of swivel bolt and nut, and 10 is a side elevation of the same; 11, 12, and 13 are the special sections of steel particularly adapted for the tool holder to be held in the rectangular tapered slot, A, 1; 14 is a side elevation of the right hand tool for cutting out corners, 15 is a front elevation, and 16 is a plan of it; 17 is a plan of a left hand tool for cutting out corners, and 18 is a front elevation of it; 19 is a plan of a right hand round-nosed tool; 20 is a plan of a left hand round-nosed tool; 21 is a side elevation of a straight tool, and 22 a plan of it; 23 is a side elevation of a cross tool; and 24 a plan of it. The tapered slots, B and C, in 1, are adapted for holding cutters severed from a bar of steel of uniform section, but thicker upon one edge than the other, as shown in section in 25. The patentees claim the constructions of the tool holder, as described and illustrated, and the three special sections of steel, particularly adapted for the rectangular tapered slot of the new tool holder. 11, 12, 13, and 25 are full size, as shown; the others are half size.

PHARMACEUTICAL APPARATUS.

BY OCTAVIUS CORDER.

It has been frequently urged upon the Council of the Pharmaceutical Society of England to provide in their rooms a set of apparatus suitable for the use of retail establishments for the making of all such pharmaceutical preparations as may reasonably be expected by a chemist of the present day. Whether it is the duty of the Council to act the part of an educating body, either for students or mature pharmacists, I leave for the present (although I have a very decided opinion on the subject), my object on the present occasion being to assist those who may be in the same difficulty which I have felt. Having no set of apparatus to guide me, I should have been glad of information. I therefore send a short description of what I have found to answer my purpose, with a drawing of the apparatus.

A is a copper boiler holding about 12 gallons, fixed in a wrought iron jacket and heated by a ring gas burner. I used copper for the boiler, because, being made thinner than iron, the water is brought to a boil much more rapidly; it does not foul so soon, and is altogether better adapted for the purpose. I chose gas as a heating power, not that it was so cheap as coal, but from its being clean, free from smoke, and at once lighted lowered, or put out, as occasion may require.

The boiler is supplied with water direct from the main by merely turning on the tap, B. The boiler is provided with steam gage, C, which blows off at 5 lbs. pressure, also with a water gage, D, and with a suitable arrangement for blowing out the boiler whenever it becomes foul by deposit of lime, etc. H is a galvanized iron tank, provided with a tin worm, so that all waste steam may be condensed as distilled water; those who are accustomed to use distilled water for all dispensing purposes, making tinctures, infusions, decoctions, indeed all pharmaceutical preparations, will fully appreciate this part of the arrangement. The whole of the pans, etc., being copper tinned, all the condensed steam is available as distilled water. The pan, E, holds 16 gallons, and is adapted for decoctions, etc.; its evaporating power is about 2 gallons per hour. The pan, F, holds 6 gallons, and being fitted with a suitable head and worm, is used for all the distilled medicated waters, such as dill, cinnamon, peppermint, etc., also for recovering the spirit from extract of colocynth and such like preparations. It distils about 1 gallon per hour. G is fitted with an earthenware still (holding about 3 gallons) with head and worm of the same material, fixed in an oval jacket. This is only used for aromatic spirit of ammonia, for which purpose it is well adapted; being the furthest from the boiler the steam power is less, and there is but little risk of the luting being displaced, especially if the carbonate of ammonia is added at several times in small quantities.

The amount of gas used is about 50 feet per hour, costing in London somewhat less than 6 cents; but by saving the condensed steam, sufficient distilled water will be obtained to more than pay the heating. If the full steam of the boiler is turned into the worm, H, about 4 gallons of water per hour are obtained. Two gallons of aromatic spirit of ammonia may be run over during the day, in conjunction with other preparations. I would add that it is well to cover the top of the boiler, and the sides of the pans and pipes, with felt, which effectually prevents a considerable loss of heat by radiation.

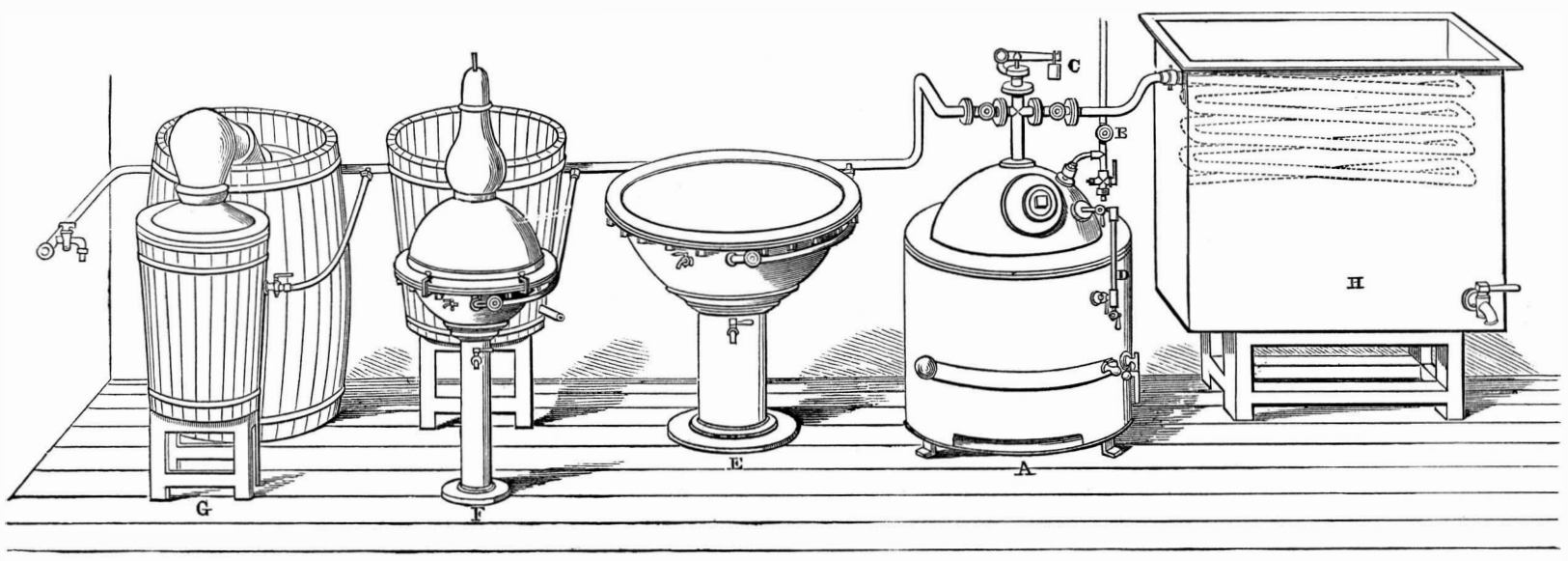
In the Dock Warehouses of London.

A writer in the *British Trade Journal* has been exploring the vast warehouses of the East and West India Docks of London, where the cargoes of whole fleets of vessels are stored, pending the sale of the goods to wholesale merchants. One particular building examined was set apart for the most valuable articles of importation, such as drugs, ivory, feathers, etc., and about which a large variety of curious and interesting information was gathered.

In the drug department one sees such costly articles as vanilla, musk, ambergris, and the various kinds of essential oils undergoing manipulation. Each package of musk is carefully sorted, and every individual pod subjected to close scrutiny, for Ah Sing has a peculiar knack of deftly introducing different foreign substances into the pods and closing them up again. Some mysterious compound, known as Chinaman's earth, is a favorite adulterant of this highly priced natural perfume. Ambergris, a peculiar secretion of the sperm whale and the base of many scents, was not a great number of years ago accounted worthless, but as much as five guineas an ounce has since been paid for it. Essential oils occupy an important place in the drug warehouse.

We noticed a large vat for the reception of cassia oil, capable of holding 200 gallons. This oil has to be turned out of its original packages and bulked, or mixed together, buyers being chary of investing in an article which exhibits very unequal quality. Proceeding from the drug warehouse, we ascend to the department devoted to ivory and tortoiseshell. The greater proportion of the former produce which reaches the London market finds its ways to this warehouse. Every separate tusk is examined here at the hands of men whose long familarity with the business enables them to detect the slightest imperfection. Each tooth bears on its surface a record of its own defects, which are expressed by certain cabalistic characters well understood by the trade. The dealer is able to place perfect reliance on these descriptive marks, and they, perhaps more than his own judgment, determine his biddings. Of the ivory of commerce, that hailing from the Gaboon is considered the best. It has a peculiar transparency, and, keeping its color well, is used for carving articles of a superior description. The largest tusks are those from Egypt and Zanzibar. One was pointed out to us from the latter place which weighed 128 lbs., this being, however, a tooth of quite exceptional size. Its defunct possessor would no doubt have proved an immense acquisition to a menagerie, for he must have been a very giant among giants. Every now and then a parcel of antediluvian ivory is forwarded from Siberia for sale. A passing glance at the tortoiseshell department reveals a good stock of that remarkable product. The cleats or pieces of shell which bind the plates together on the reptile's back were at one time valueless, but, strangely enough, now find a market in Japan as the material for the native jewelry.

Another floor of the warehouse introduces us to a rather



SIMPLE PHARMACEUTICAL APPARATUS.

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novel show, that of birds, birdskins, and feathers. Here are cases upon cases and piles innumerable of feathered victims, from the magnificent Impian pheasant off the Himalayas to the tiny humming bird of tropical America. The birds and birdskins are carefully sorted, and particulars taken for the transmission to the brokers, who are thus able to prepare their sale catalogues. One of the latter is before us, and although it is only a supplementary one the following are among the goods it specifies: 3,297 jays, 1,073 kingfishers, 1,047 ospreys, 649 red and orangetanagers, 394 parrots, 98 red ibis, 1,095 bee eaters, 653 bronze merles, 1,416 humming birds, and 2,023 various. Coming to the feathers, ostrich, of course, occupy the place of honor, both as regards quantity and relative value. Among other feathers are those of the osprey and the marabout or paddy bird of India. The latter are very pluffy and graceful in appearance, and in color are either a snow white or gray. The whole of the feather and bird business of London is concentrated in this warehouse, and the value of the peculiar merchandise here on show monthly is something about $250,000.

The storage room, devoted to silk, is very considerable; and as far as possible, the different varieties, of which the principal are Bengal, China, and Japan, are kept distinct. Each skein has to pass muster, the inferior or damaged ones being thrown out; and the merchantable bulk of every bale is then enclosed in a hessian covering, which, when sewed up, constitutes a company's package. Bengal silk is in skeins, that from China in flattened bundles or books, and the Japanese skeins are tied up in grape-like bundles. The twine used by the Japanese silk packers is made of paper, but nevertheless wonderfully strong and of beautiful regularity. They are very liberal in the use of paper bands, which enclose the skeins in all directions; but as this paper is carefully preserved by the sorters and weighed off against the bale, the not over scrupulous "Japs" are defeated in their object, which is to get credit for paper as if it were silk. In the storerooms are between five and six thousand bales of silks. The facs of blinds being fitted to all the windows is calculated to puzzle the uninitiated, but this is a precautionary measure of some importance, it being found that the exposure of silk to light and warmth results in appreciable loss of weight.

The chief source of the indigo supply is India, but of late years the Central American States have been sending increasing quantities to this market. Bengal indigo, especially that classed by importers as Bengal blue, is most highly esteemed. Then follow Bengal violet and copper indigoes, and after these rank Oudes and Madras. The culture of the indigo plant is very precarious; and it thus happens that, although the consumption is tolerably uniform, the price is liable to violent fluctuations.

Inside the indigo warehouse there is but one universal color, and that is blue. The atmosphere is of a cerulean haziness, and the men, as they move about, give one the impression of having been in a dye bath. Certainly the blueness of Gainsborough's blue boy would have been doubly intensified by a brief sojourn in this region. The cases of indigo are weighed, tared, and samples drawn for display in the show rooms on the fifth floor. The skylights of these fine rooms are so arranged as to throw the light from the north on the samples of indigo arranged in long lines of trays below. Color is, of course, the chief guide to quality, lightness being also a characteristic of good indigo.

Correspondence.

A Colossal Fortune Undeveloped.

To the Editor of the Scientific American:

For many years the subject of limiting the production of cotton, to bull the price to a more remunerative figure, has engaged the attention of many cotton planters in the South. If but a tithe of the mental labor which has been fruitlessly expended in this direction could be devoted to the invention of means by which the cost of production of cotton could be diminished 1 cent per lb., we might well look for most important results.

In the great Northwest, there has grown up within a few years a gigantic empire, teeming with its millions of thrifty farmers, who are able, by the aid of improved agricultural machinery, to produce the grain crops which feed a notable part of the civilized world. It is well known that this great result would not have been possible without the labor-saving machinery which has enabled them to compete in the markets of the world. But if we look at the cotton culture of the South, it is matter of great surprise that the production of so important a staple, involving so much constant manual labor, should have received so little assistance from inventors. There cannot be a more inviting field for mechanical ingenuity than this; and having given this subject much thought for ten years, I wish to direct the attention of mechanics to the nature of the demand and the probable means by which the supply can be achieved.

A given number of hands, in the rich cotton belt, can plant and cultivate double the quantity of cotton during the spring and summer that they can gather and prepare for the market in the fall and winter. Here, then, is a limit to the production of cotton which compels the culture of other crops in connection with cotton, crops which do not require labor in the season of cotton picking. Machinery for harvesting the cotton crop will enable the planter to double the quantity of cotton which can be produced by a given number of laborers. Here, then, is the first great want of the cotton grower.

I believe the man who successfully supplies this great want, by inventing machinery which will do for the cotton crop what the improved reapers are doing for the wheat crop of the Northwest, will require a sewing machine to make his money bags. Then application of the buggy plow to the cultivation of the cotton plant will naturally follow, and still further diminish the cost of production.

Shortly after the late war, an ingenious Yankee exhibited in the South a device for picking cotton, which did the work, it is true; but it required to be brought to bear upon the cotton boll with something of the precision which points a gun at a bird. A southern negro would easily gather ten locks of cotton in the time required by the inventor to bring this cotton picker in contact with a single boll.

If I could be permitted to advise the would-be inventor of a cotton-picking machine, I would say: Take your first lesson in a cockleburr patch, as it is here called; pass through it, and note how tenaciously the numerous barbed points upon the burrs catch and hold your clothing. Thus you will find the first elementary principle of the cotton picker. Pass through the patch again upon a windy day, and note how your coat tail flies about in the wind, hunting, as it were, for the burrs that so readily seize it; and note also the increased number of burrs you bring away with you. Here you have a second lesson in the elements. Expand the cockle burr into a drum or cylinder covered with card clothing, such as is used in treating cotton or wool, but with teeth so fine as to exclude the limbs and leaves of the plant, seizing only the lint. Let there be two of these card cylinders, revolving in opposite directions, one upon either side of the row of plants; let them be placed nearly upright, leaning obliquely towards each other like the opposing rafters of a roof, so as to conform somewhat to the pyramidal form of the plant; let them be geared so that they can be raised or lowered by a lever to suit the hight of the plant, and so that they can be approximated or separated to suit the breadth of the plant. Let each cylinder be provided with a comb or counter card, to remove the accumulated cotton from the card teeth, and drop it into a proper receptacle upon the machine. Let the whole be mounted upon broad-tired wheels and drawn by two horses, one upon each side of the row of plants. Let a suitable rotary fan be attached below, to send a strong draft of air up through the cotton plant to put the long, loose locks of lint in active agitation, so that they shall industriously search for the card teeth, and also to blow away sand and dust from the lint, and thus improve its quality. Do this, and you have the dry bones of a cotton picker, to be carefully studied, elaborated, and clothed in suitable habiliments, such as this writer has neither skill nor time to devise.

It is not necessary that the cotton picker shall do its work cleanly; if it can but garner two thirds or three fourths of of the crop, manual labor will take care of the remainder. The customary price for picking cotton by hand is 75 cents per 100 lbs. of seed cotton, the average yield of which, in marketable lint, is 33 lbs. The cost of hand picking, therefore, is 2¼ cents per lb., a very large item, which ought to be reduced, by appropriate machinery, by more than one half. A successful inventor who should exact as his royalty only ⅛ of 1 cent per lb. upon the cotton crop of the United States might fairly figure his annual income at more than $3,000,000, a sum worth striving for by any mechanic who has the gift of invention.

If these suggestions should drop a germinating seed into the fertile brain of the coming man who is destined to immortalize himself by the invention of a successful cotton-picking machine, I shall be most happily rewarded for my own part in the matter.

ROBERT BATTEY, M. D.

Rome, Ga.

Boiler Explosions.—A Suggestion to Experts.

To the Editor of the Scientific American:

The importance of the subject emboldens me, although not an engineer, to ask for a little space in your valuable journal, to allow me to rejoin to a communication from L. B. Davies, as to the cause of boiler explosions, which appears in your issue of November 18. I beg to be understood in advance that I have no intention of opening a controversy with an expert such as Mr. Davies seems to be, and that what I shall say is to be taken merely as a suggestion to practical engineers that, possibly, there may be a cause for such accidents which has been overlooked. The experiments as to the action of water under repeated heating, that I shall presently detail, were instituted three years ago in consequence of a series of investigations described, if I rightly remember, in the *Journal des Débats*, of Paris. The point was not directly raised by the article, but some collateral statements led me to question whether water, such as is ordinarily used for motive purposes, might not possibly acquire an explosive property by frequent heating. Although water is a protoxide of hydrogen, as a matter of fact, as found in its natural state in rivers and reservoirs, it contains a considerable percentage of nitrogenous admixture, partly in the form of animal and vegetable life containing nitrogen, and partly in compounds resulting from the decomposition of animal and vegetable tissues. The sedimentary coating it deposits in boilers, and the column of sediment that settles in a test tube after protracted boiling, are sufficient evidence as to the importance of the compounds held in solution to any careful and accurate investigation of the causes of explosion, in instances where inspection has failed to reveal any defects in the boiler itself. Again, under protracted jar, iron columns often acquire molecular properties that render them extremely brittle, and it is very possible that boiler iron under frequent heating and tension, saying nothing of inequality as respects both, may suffer molecular changes that cannot readily be detected even by an expert.

The experiments I have to detail were conducted in test tubes, with Croton water first, and afterwards with water obtained from the Hudson river. The degree of heat employed was uniform. The tubes used were two ounce, tightly corked with rubber stoppers, through each of which was passed longitudinally the refuse spout of a subcutaneous syringe, for the escape of steam. For the experiment I used seven tubes, each loaded with half an ounce of water. Six of the tubes were employed in this manner, namely, five of the six as a reservoir with which to replenish the sixth, thus eliminating one after another until only the sixth should remain: the seventh to be replenished with fresh water as often as the exhaust reduced its contents to one third of an ounce. That is to say, heating each in succession for five minutes: as often as the contents of any one of the first six was less than one third of an ounce, it was brought back to the original volume of water by replenishing from out its fellows, and so on until five of the six were empty; while, when the seventh had lost one third of its contents, the deficiency was supplied with fresh water from two and a half ounces reserved. The tubes were of average thickness. The interval allowed between boilings was one hour, during forty minutes of which the tubes were suspended in cold water to insure the necessary lowness of temperature. The thermometrical tests in each case were made with a very correct medical thermometer; and the external surface of each tube after cooling was carefully cleaned with a strong solution of caustic potash. The heating instrument was an alcohol lamp, filled after each series of heatings and carefully trimmed; and previous to each series I took the precaution to heat four ounces of fresh water in a tin cup for seven minutes, and then to test the heated water with the medical thermometer, in order to prevent any appreciable variation of temperature. Under these conditions, the test tubes being suspended by a wire loop always at the same distance from the tip of the wick, each time I found that there was a fixed diminution in the time required for perceptible boiling, after each experiment, and that the loss in volume by conversion into steam increased a trifle at each heating. The average first term with all the tubes was 3 minutes and 41 seconds. The last half ounce of the three ounces allotted to the six tubes replenished from each other boiled in 2 minutes and 47 seconds. The same quantity in the seventh tube, constantly replenished with fresh water, boiled in 3 minutes and 5 seconds, the diminution in time being 54 seconds in the one case, and only 36 in the other. Using three ounces of water from the Hudson river, in six tubes, under the same conditions, the average time of boiling at the first series of heatings was 3 minutes and 38 seconds, while the last half ounce boiled in 2 minutes and 27 seconds, a diminution of 71 seconds. Using three ounces of filtered Croton water, under the same conditions, the first term was 3 minutes and 49 seconds, and the second 3 minutes and 13 seconds, a difference of only 36 seconds.

I have carefully repeated these experiments a sufficient number of times to convince me that these phenomena are pretty constant; and, from the difference between filtered and unfiltered water in respect to them, it must be concluded, I think, that the presence of organic compounds has considerable influence in bringing them about. There is also a phenomenon, not readily described, but one readily appreciable by the eye—a manner of boiling, so to speak—which would enable an expert to guess pretty accurately whether a volume of water had been frequently heated, or was merely undergoing that process as virginal. It consists principally in the fact that water that has been persistently boiled and cooled breaks suddenly and violently into ebullition, as compared with fresh water under the same degree of heat. The experiments seem to indicate that nitrogenous compounds are responsible for this phenomenon, which in the last half ounce of a three ounce reduction pretty broadly suggests that the liquid under experiment has acquired an explosive property that, under such conditions of high heat as occur in using steam as a motive power, might prove very dangerous and destructive. I will not presume to say that experiments conducted on such a small scale are conclusive, save as establishing the fact that ordinary water acquires the property of yielding to heat the more readily in proportion to the number of times that it is heated, and that an increased rapidity of conversion into steam accompanies each increment of this change in molecular properties. I believe that nitrogenous compounds are responsible for this change and for the sudden violence of ebullition that accompanies it; but this point I have not been able to verify with the facilities at my command.

New York city. F. G. F.

Suspended Animation as a Preserving Agent.

To the Editor of the Scientific American:

On page 225 of volume XXXIII of the SCIENTIFIC AMERICAN, you have an article on the above named subject in which you give three different lines of investigation for future experiment. These are: 1. The power some animals have of rendering their natural prey utterly insensible for an indefinite period. 2. The peculiar effect of cold on some of the lower animals, which reduces them to a state, not death, nor yet the ordinary torpidity caused by low temperature in other organisms. 3. Hibernation. In considering each in turn, you give as an instance of the first the complete torpor or anæsthesia produced by the sting of the female of the "digger" wasp upon its prey; of the second, the well known torpor produced by cold in the case of serpents and certain fish, with subsequent return to activity on the application of heat: and lastly, hibernation is explained by the fact that "the muscular irritability of the left ventricle of the heart, highly increased, permits it to contract under the weak stimulus of

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the non-oxygenated blood. It is this exaltation of a single vital property which preserves the animal life." One or two quotations from recent lectures of Dr. Brown-Séquard in your city will serve to indicate several other methods of investigation. The learned doctor gives an instance of a dead ox having been kept 56 days without putrefaction. M. Flourens considers that a spot in the *medulla oblongata* is the focus of vital force. There is, you know, a spot which is pierced by the matadors in Spain when they rush to kill a bull immediately. Death occurs instantly. * * It is interesting to know what becomes of the nervous force in these cases. It seems to have been altogether lost. I say it seems, for if we examine a little further we find that it is only dormant. The nervous centers have lost it almost altogether, but the nerves are quite rich in nerve force, so much so that I have kept one of those animals for nearly 65 days in my laboratory, without any trace of putrefaction, at a temperature which varied between 45° and 65°. The lack of putrefaction certainly depended on the long persistence of the nerve force after death."

Animals thus killed could no doubt be transported across the Atlantic from North or South America, in sailing vessels, without loss of weight and with little expense. It would be interesting to know if simple compression of the *medulla*, as by a ligature, for example, would not so suspend animation that it could be recalled at pleasure.

I quote further from the same author: "You know that they (the fakirs of India) may remain dead to all appearance for a number of days, and, it is even said, for months, without any change occurring in the body, without any change in the weight, without their receiving any food. They show neither circulation nor respiration, as their temperatures diminish very considerably, and altogether present a series of effects which are certainly very marvelous. But in the light of the fact that I had a dead animal in my laboratory lying for several months without any sign of decomposition, in a temperature varying from 40° to 60° during day and night, we can understand that these fakirs may remain able to live although they do not live—that is, they do not have actual and active life. But why, you will say, do they come out? Admit that there is in us a power which is quite distinct from our ordinary power of mind, which is quite distinct from that which we call consciousness, which during our sleep is awake and watches: with this admission and the facts I have mentioned above, we have all the elements, I think, for an explanation of what has been said about the fakirs."

Although I do not quite comprehend this explanation. I have thought it well to allude to it, as leading to a possible solution of the problem given toward the close of your article, namely that of having our own sensation and volition suspended at will, indefinitely.

Chatham, N. B., Canada. JOHN MCCURDY, M. D.

The Supposed Planet Vulcan.

To the Editor of the Scientific American:

I felt much interest in the discussion on the planet Vulcan; and if all the observations are genuine, they are totally irreconcilable with any hypothesis as to the periodicity of the planet yet proposed. I think it was in the winter of 1872 that I gave you my observations, which you published, of a transit of the planet seen—as I have since determined—by me on September 15, 1859, in the forenoon. If I recollect rightly, I gave the diameter of the planet as apparently 2¼ inches, taking the apparent diameter of the sun as 28 inches. This was about 8 o'clock, A. M., when the planet had just entered on the eastern limb of the sun, a little south of the sun's equator. The sun being near the horizon, it was enlarged by refraction. The planet was nearly, if not quite, two hours in making the transit, and I looked at it every five or ten minutes. We used only a smoked glass. In studying and comparing the phenomena I attributed to this planet, I found a regular recurrence of the phenomena at about the end of 23 days. By averaging the periodicity, I fixed it at 23·02 days. During over ten years I have minutely observed the recurring phenomena, with a view of verifying both the theory and the periodicity, and I have found but little if any variation in the periodicity. I do not claim that it is exact, but I am satisfied it is as near an approximation as can be arrived at until the planet's true position is determined.

I believe that the planet has an enormous size, at least equal to that of Uranus: and therefore the planet has never been seen by the observers who saw small black specks make transits of the sun. If any such speck has been seen, of which there can be no doubt, then it was a satellite and not the planet. I believe, however, that Mayer saw the planet make a transit on March 15, 1758, when he saw a spot one twentieth the diameter of the sun, which agrees in size with my observation in 1859.

It is to be regretted that M. Leverrier rejected all the observations where no forward movement of the speck was observed; for if it were a satellite, it might for a time be stationary, or have even a retrograde as well as a forward movement. The following calculations have recently been made:

From 1758, 74 days, when seen by Mayer at the descending node, to 1859, 258 days, when seen by Tice at the ascending node, is 101 years and 184 days = 37074·24 days ÷ R (23·02) = 1610½ revolutions + 0·55 days.

From 1758, 74 days (Mayer), to 1859, 85 days (Lescarbault), is 101 years 11 days = 36900·25 days ÷ R = 1603 revolutions + 0·19 days. Both these observations were at the descending node; therefore a whole number expressed the number of revolutions.

From 1758, 71 days, to 1876, 91 days (Wolf and Weber, April 4, 1876), is 118 years and 20 days = 43119·50 ÷ R = 1873 R + 3·08, from which deduct 2 days for the time it will take the planet to move from node to inferior conjunction, leaving 1·0 days. My position for the planet was for April 3, 1876, at its inferior conjunction, or the day before the observation of the small speck.

From 1859, 85 days (Lescarbault), to 1859, 258 days (Tice), is 173 days = 7½ revolutions + 0·36 days. From which has to be deducted difference between time in Europe and America, which will leave a difference of between 2 and 3 hours.

Mayer's observation and the observation of October, 1802, gives 707 revolutions + 2·98 days, deducting 2 days for passage from node; this leaves 0·98 day; but one is an observation at the ascending node, and the other at the descending node, therefore there should be half a revolution. It is therefore half a revolution, say 11·50 days, short. But here a remarkable fact occurs, a series coming in as though there were two planets, half a circle, 180°, apart, and revolving around the sun in the same period, 23·02 days.

From October 10, 1802, to October 2, 1839, is 13,506 days = 591 revolutions + 1·58 days.

From 1839, October 2, to March 12, 1849, is 3,448 days = 145½ revolutions + 0·9 day.

From 1839 to either of the observations of 1859, there lacks half a revolution. The observations of 1802, 1839, 1849, lack half a revolution when compared with 1758, 1859, 1876. The observation of March 20, 1862, has no corresponding observation, differing with one series 7·56 days, and 14·08 with the other. The observations published in SCIENTIFIC AMERICAN for July 23 and October 24, 1876, belong to the series of 1802, 1839, and 1849. They are midway between the latter series and those of 1758, 1859, and 1876. From July 23 to October 24 is 92 days; four revolutions of 23·02 days are 92·08 days.

It will be seen that the component elements of the problem as far as known are irreconcilable, because some may not be authentic. The way out of the difficulty is to look for the planet, not the satellites, outside of the sun when at its greatest eastern or western elongation. Its immense size will render it visible twice for a day or so on each revolution, under proper conditions of the atmosphere. I did see it, and showed it to my family on the afternoon of June, 1876, in the exceptionally blue and serene atmosphere of that day. It was about five or six apparent solar diameters northwest of the sun.

It probably may make a transit of the sun on March 12, 1877, as it will be at its inferior conjunction on that day and very near the node. I expect it to make a transit on March 14 or 15, 1878, and on the 14 or 15 of September, 1882. It may be visible at the total eclipse of July 29, 1878, but it will be very near the sun, having passed its inferior conjunction a day or two before. JOHN H. TICE.

St. Louis, Mo

A New Method of Cutting Screws.

To the Editor of the Scientific American:

Thinking a method for cutting screws would be of benefit to some of your readers, I send you the following, which is not generally known:

When the screw tool has cut the required length of screw, the quickest way of taking the saddle back is by hand; and to do that, the part of tailstock which comes in contact with the saddle must be set a certain distance from it; and to find that distance, it must be known which are the right places for putting the nut in and out of gear with the leading screw. But previous to setting the tailstock the required distance from the saddle, the screw tool must be set true and opposite the end of the work to be screw-cut—where in some cases a hole is drilled—likewise the nut in gear with the leading screw. The following rules for getting the above distance will be found to answer for any pitch of leading screw: First, when the number of threads per inch required to be cut can be divided by the number per inch of the leading screw without any remainder, the nut will be right when in gear with any part of the leading screw. And in all other cases, multiply the number of threads per inch that you wish to cut by some number of inches (which will depend upon the length of the screw to be cut) that will give an even number, which will be the proper distance to move the saddle.

I have used this mode for several years on both male and female screws of single, double, and triplethreads, and have never known it to fail.

Smithville, N. J. EDWIN JUDD.

Smiler's Health Lift.

Dr. Smiler, says Max Adeler, had a large tank placed on the top of his house from which to supply his bathroom, and so forth, with water. The water had to be pumped up about fifty feet from the cistern in the yard, and the doctor found it to be a pretty good-sized job, which would cause him constant expense. So after thinking the matter over very carefully, one day an idea struck him. He built a room over the cistern and put word "Sanitarium" over the door. Then he concealed the pump machinery beneath the floor, and he rigged up a kind of complicated apparatus with handles and hinges and a crank, so that a man by standing in the middle of the machine and pulling the handle up and down would operate that pump.

Then the doctor got out circulars and published advertisments about "Smiler's Patent Health Lift," and he secured testimonials from a thousand or so people who agreed that the health lift was the only hope for the physical salvation of the human race. Pretty soon people began to see about it, and Smiler would rush them out to the "Sanitarium" and set them to jerking the handles. And when a customer had pumped up fifty gallons or so, Smiler would charge him a quarter, and tell him that three months of that kind of thing would give him muscles like a prizefighter.

The thing became so popular that he had to enlarge his tank and put in a smaller pump; and he not only got all his pumping done for nothing, but the people who did it paid him about $1,500 a year for the privilege.

One day, however, Mr. Maginnis, who had been practising at the health lift every day for months, broke the board upon which he was standing, and plunged into the cistern, and just as he was sinking for the third time Smiler fished him out with a crooked nail in the end of a clothes prop.

A few days later Maginnis came round with a lot of other patients, and cross-examined Smiler's servant girl, and learned about the truth, and then they went home mad. A consultation was held, at which they resolved to prosecute Smiler for damages and for obtaining money under false pretences. It is thought by good judges that, by the time the court get through with Smiler, it will be about the unhealthiest lift for him he was ever interested in.

Sawmill Machinery.

The building devoted to the sawmill exhibit, which is situated at the base of George's Hill, presents, says one of our contemporaries, a sight to the inquiring mind both interesting and instructive. In it may be seen, in operation, all the processes and machinery of a regular sawmill, all the leading manufacturers of this important branch of machinery being represented. The exhibit which attracts the most attention is that of the Stearns Manufacturing Company of Erie, Pa., who have some of the most beautiful pieces of mechanism at work that we have ever seen. To them was awarded a prize medal and diploma of merit for their machinery, on account of its manifest superiority of construction, in the many novel features and important improvements they have made (which are patented), and general excellence of workmanship. The Stearns Manufacturing Company have long been regarded as being at the head of this branch of business, and their productions may be found in sawmills all over the country. The central object of interest in the whole sawmill building, one which commands the attention of all the mill men, is a saw which cuts through a sixteen foot log in one and a half seconds of time, every revolution of the saw cutting in 10½ inches. This is the highest speed ever before attained, and shows conclusively to what a high degree of perfection they have brought their machinery. The work exhibited by them, in all its details, speaks emphatically for itself, and shows that the Stearns Manufacturing Company have no need to fear any rivals in their business, as their workmanship cannot be excelled. This is all the more true when we consider that those articles are taken from regular stock, and are not made specially for exhibition. A better idea, therefore, can be had of the general excellence.

Prompt Payment.

"Prompt pay is the key to all success in business. There are times in the history of every trader when he finds it inconvenient to meet his bills promptly, and in such case we find the man who knows his credit to be good becoming lukewarm, forgetting that his creditors are calculating upon him perhaps to meet some pressing obligation. The result is that he disappoints them, and thus, after one or two repetitions of the same, even the man whose credit is first class can soon impair it, and sometimes to a degree that makes it hard for him to recuperate. Now let us take the man of moderate (say fair) credit. He knows under such circumstances that his credit is scrupulously watched; and if his bills begin to lapse, he is at once notified of it, and informed that unless past bills are paid no more goods can be procurred. With such a contingency facing him, he sees it is to his interest to meet his payments promptly, and is on the high road to success. Prompt pay does two important things—it inspires confidence in the seller, putting the buyer upon a first class basis, and it insures the prompt shipment of goods."

Our English contemporary, whence we extract the above sound advice, forgets to point out that there is a still greater advantage in seeking no credit at all, but in making payment at once. Persons who have not tried the cash system (and we mean not merely in ordinary business transactions, but everywhere, even in the small expenditures of the household) has any idea how much it simplifies the transaction and benefits both the buyer and seller. Moreover it is a saving to the purchaser of a very large percentage. We have found, by inquiry among many retail dealers in this city, that such houses as are in the habit of allowing credit to their customers, from six months to one year, add on an average of at least ten per cent to the cash price. And this must be so, because the dealer cannot afford to lose the interest on his money and take the risk of a failure of payment of a portion, which is inevitable. Another fact for debtors, more especially of wine merchants, tobacco sellers, and tailors, is worth remembering: and that is that, where one of these dealers gives credit, he calculates that a certain percentage of the debts will never be paid, and this percentage is necessarily added to the charges made to all customers, both time and cash. There are multitudes of other benefits, which will suggest themselves to any thoughtful person, all accruing by the prompt cash system.

THE American Institute Fair closed on November 25. Mr. F. D. Curtis delivered an oration, in which he stated that the entries at the exhibition numbered 1,233 and the visitors over 500,000. Awards were given in the usual wholesale manner.

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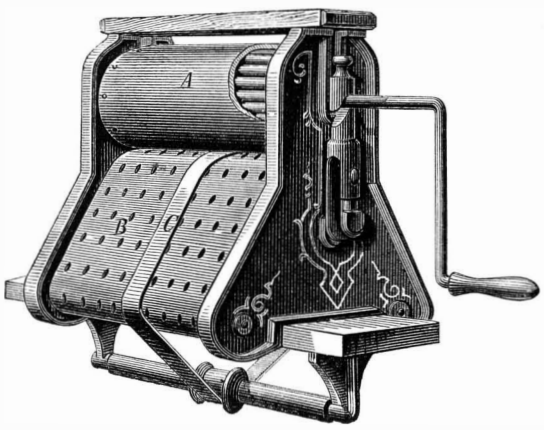
DENNEY'S IMPROVED WASHING MACHINE.

We illustrate herewith a new roller washing machine which is claimed to wash fabrics of any degree of fineness thoroughly and without injury. It is also adapted to the cleansing of garments, etc. The frame of the machine is made of cast iron, galvanized. The top roller, A, has longitudinal corrugations, and is covered with a sleeve of vulcanized rubber, which consists of a ply of cotton duck, having merely sufficient rubber on its under side to protect it from the action of the water, the requisite degree of elasticity being secured by the application of the greater thickness of rubber to the outer surface. The lower roller is provided with peculiarly shaped channels, differently spaced from the the corrugations on the top roller. There is thus created an abrading action when the machine is working, while a pressure is exerted by the top roller, which is held down by detachable springs. The endless apron, B, passes over the lower roller and down around small carrying rollers, as shown. The rubber cloth of which it is made is prepared with the greater amount of rubber on the upper surface, which fits it for contact with the most tender articles to be cleaned. The band is perforated so that the air and water contained in the channels of the under roller are utilized by being driven through the clothing. The inclination given to the band causes the clothes to adhere to it, so that they can be run through past the top roll, and thereby cleansed out to their extreme ends. The apron acts as a conveyer, also to carry a larger quantity of water along with the clothing



to the rolls while the water may be used much hotter than usual. The rubber conforms to the uneven thicknesses of the clothing. The machine is designed to be used in an ordinary washtub.

In order to prevent the finer articles from sticking to the endless apron, a small narrow band, C, is passed around the apron, which band is carried down around a lower roller, so as to pull off the articles as they descend into the water.

Patented by S. L. Denney, June 1, 1875, and May 9, 1876. For further particulars address the inventor at Gap, Lancaster county, Pa.

A Variety of Rare Chemicals for Twelve Cents.

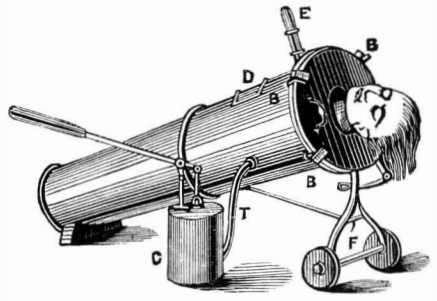
A writer to of one of our exchanges, who has been assiduously perusing our scientific dissection of a cigar, wants to know how, with such an array of rare chemicals as pyridine, lutidine, pyridine, etc. ("not to mention cabbagine and burdockic acid"), any one can expect to buy a good cigar for less than ten cents. This is a financial view of the subject which had not occurred to us, but a moment's consideration shows that it conceals a specious sophistry. Let us reply, Yankee fashion, by another question.

How can any one expect the cost of living to be further reduced when a pound of butyrolic acid, butyric acid, capric acid, caprilic acid, caproic acid, palmitic acid, myristic acid, vaccinic acid, stearic acid, oleic acid, oxide of lipyle, chlorine, sodium, potassium, phosphate of lime, phosphate of magnesia, casein, lactose, mucus, albumen, iron, glycerin, hircine, lacto-protein, lacto-albumen, besides bixin and orellin and hair (all of which, according to an actual assay of one of our metropolitan chemists, go to make the compound known as boarding house butter) is obtainable for 12 cents?

THE SPIROPHORE.

This apparatus was recently described to the Paris Academy by M. Woillez. It is for restoring asphyxiated persons, especially such as have been in danger of drowning, and new born infants. We are indebted to the *Journal de Pharmacie et de Chimie* for the annexed engraving of the apparatus. It consists of a cylinder of sheet iron closed at one end and open at the other. The case is large enough to receive the body to be treated, which is let down into it as far as the head, which remains outside. A tightly fitting diaphragm closes the aperture about the neck. A strong air pump, C, containing more than four and a half gallons of air, is situated outside of the case, and communicates with it by a thick tube, T. It is worked by means of a lever, the descent of which produces aspiration of the air confined about the body. The raising of the lever again restores the abstracted air to the case. A transparent piece of glass, D, on the upper part of the cylinder enables one to see the chest and abdomen of the patient, and a movable rod, E, sliding in a vertical tube, is made to rest on the sternum.

M. Woillez states that he has made several experiments with the apparatus, the general results of which are as follows: When a human body is inclosed as described, and the lever quickly lowered, a vacuum is produced round the body, and immediately the external air penetrates into the chest, the walls of which are seen to rise as in normal life. The ribs separate, the sternum is pushed up 0·393 inch at least (indicated by the movable rod which rests on it). Further, the epigastrum, and even the abdomen below, present an inspiratory projection, which shows that the enlargement of the chest is effected during this artificial inspiration not merely by the raising of the ribs and the sternum, but also



by the descent of the diaphragm. All returns to the former position when the lever is raised again. These compiete respiratory movements may be repeated fifteen to eighteen times in a minute, as in a living man.

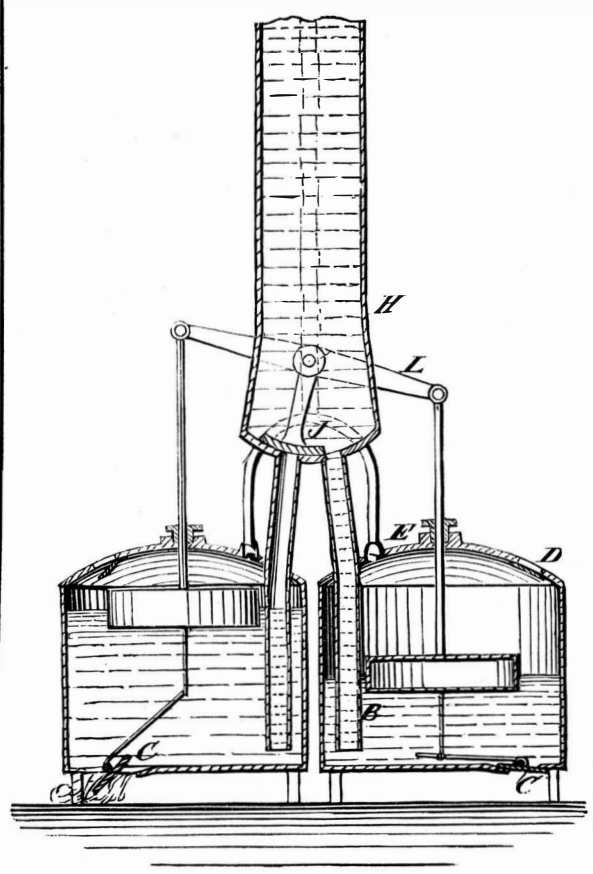
By means of a tube fixed into the windpipe of the body, and communicating with a graduated reservoir of air over a vessel of water, M. Woillez has measured the quantity of air which thus penetrates into the chest at each pressure of the lever. He finds that this is, on an average, 1¼ pints; whereas the physiological average is only $\frac{7}{10}$ pint. More than 22 gallons of air can be made to traverse the lungs of the asphyxiated person in ten minutes.

It is easy, then, to see the advantages presented by this apparatus for treatment of the asphyxiated, especially drowning persons and new born infants. In all cases of asphyxia by vitiated or insufficient air, or by certain poisonings, in paralysis of the respiratory muscles, in most dysphoric affections, in asphyxia by bronchial mucosities, and that due to inhalations of chloroform, and lastly, in determining some cases of apparent death, the spirophore may be used to produce an efficacious artificial respiration.

This respiration is without danger to the lungs, which are not liable to rupture, however strong the action of the lever. This innocuity is due to the fact that the force of penetration of the air into the lungs is never superior in this case (as also in the case of normal life) to the weight of the atmosphere.

A NOVEL AIR COMPRESSOR.

The annexed engraving represents a new machine for compressing air by water pressure. Two cylinders, placed side by side, have an inlet pipe, B, and an outlet valve, C, for water; there is also an inlet, D, and outlet, B, for air, and each cylinder contains a float, F. The pipes for admitting water extend from near the bottom of the cylinders, to cut off the air, into the curved bottom of a penstock, H, in which is a rock valve, J, for alternately opening and closing the passages to the respective cylinders. The stem of this valve extends out through the penstock in a suitable stuffing box, and connects with a rocking beam, L, one end of which is connected to the float, F, of one of the cylinders by a rod, M, and the other is connected to the other float by a similar



rod. The valves, at C, are so connected to the floats that, when they are raised by the water to the required hight, the floats open them to let the water escape and reverse the machine. By the filling of the cylinders with water the air is forced out through outlet, E, into the receiver; and by the escape of the water the cylinders fill with air again, to be again expelled into the receiver. This device was patented October 24, 1876, through the Scientific American Patent Agency, by Mr. Henry H. Sawtell, of Randolph, N. Y.

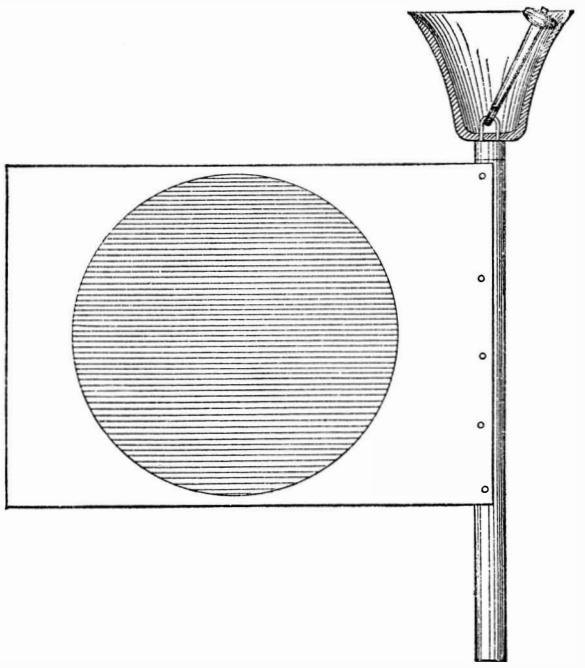
Spontaneous Combustion of Sawdust.

Sawdust is a dangerous material wherewith to fill spittoons, nor is it a wholly safe substance to strew upon floors. Several cases have recently been noted where conflagrations have been caused by cigar stumps igniting the sawdust, which smoldered slowly in the receptacles, unperceived, and finally set fire to the adjoining woodwork. Sawdust, moreover, when slightly impregnated with oil or grease, is very prone to spontaneous combustion. We published, not very long since, an instance where the sawdust sifted down through cracks in the floor boards, and accumulated between the beams, where it absorbed spilled oil. It eventually burst into flames which nearly destroyed the entire edifice.

A SOUNDING HAND SIGNAL FOR RAILROADS.

To the end of the handle, to which the ordinary signal flag is attached, a bell, C, a rattle, or other sounding device is fastened, so that it may sound when the flag is waved, and thus call to it the attention of those who may be looking the other way, and who might not observe the signal. Instead of a flag, a lantern or other sight signal may be used, so as to give a sight and a sound signal at the same time.

This device might be useful in foggy weather, when locomotive engineers may not be able to discern the color of a



flag, or when the latter is altogether, at short distances, obscured by the fog.

Patented through the Scientific American Patent Agency, September 19, 1876, by Mr. S. Brown, of Philadelphia, Pa.

Removing Nuts from Clips and Bolts.

The London (England) *Carriage Builders' Gazette*, in answer to a writer who asks as to the best means of getting off the nuts of bolts and clips, and of driving up bolts and clips, without destroying the screws, gives the following reply:

When the clips twist ever so slightly in trying to unscrew the nuts, cease to try until you have enlarged the nut by holding it for a minute or two with a pair of red hot tongs. If the clip has an extra point on it, file it round and oil it; then try. If still firm, cut the nut in halves with a chisel, having another long chisel or iron bar held against the opposite side of the nut to take the force of the blows of the hammer. Be sure to use a light bolt hammer, which is more effective than a heavy hammer—it is better to cut off twenty nuts than to break a clip. For driving up bolts so as not to bruise or burr up the screw, unscrew the nut one turn only, or enough to cover the point of the bolt; then drive the bolt back by striking the nut; if immovable, get somebody to hold a heavy hammer on the nut while you strike forcibly the iron on each side of the head; if set fast, apply the end of a hot iron bar to the side of the head of the bolt to expand the iron. If you cannot start the bolt for the want of room to strike a fair blow on the bolt point, get somebody to hold the edge of a long piece of heavy tire iron on the bolt point; them with a heavy hammer strike the bar as near the bearing as you can get at. Sometimes if the bolt is through a scroll iron, and where the spring is in the way of the hammer, a peculiar shaped drift pin has to be used—it is someting like a tuning fork; the fork being put on the driving bar at right angles, the bar is struck to drive the drift pin up the bolt hole.

The Supposed Planet Vulcan.

Astronomer Royal Airy gives M. Weber's observation—on which it will be remembered the recent predictions by Leverrier of a transit of the supposed planet were founded—its *coup de grace* by producing two photographs of the sun, taken on April 4, Weber's date, showing the imaginary planet to be a sun spot beyond question. It appears as a nucleus, without penumbra and surrounded by a small group of faculæ.

IN accordance with a long-established rule, all subscriptions terminating with this volume will be discontinued at that time. We trust that all our subscribers will not only renew, but that they may find it convenient to induce some of their neighbors to become subscribers. We shall in the future, as in the past, give our readers full measure and running over, in return for their money.

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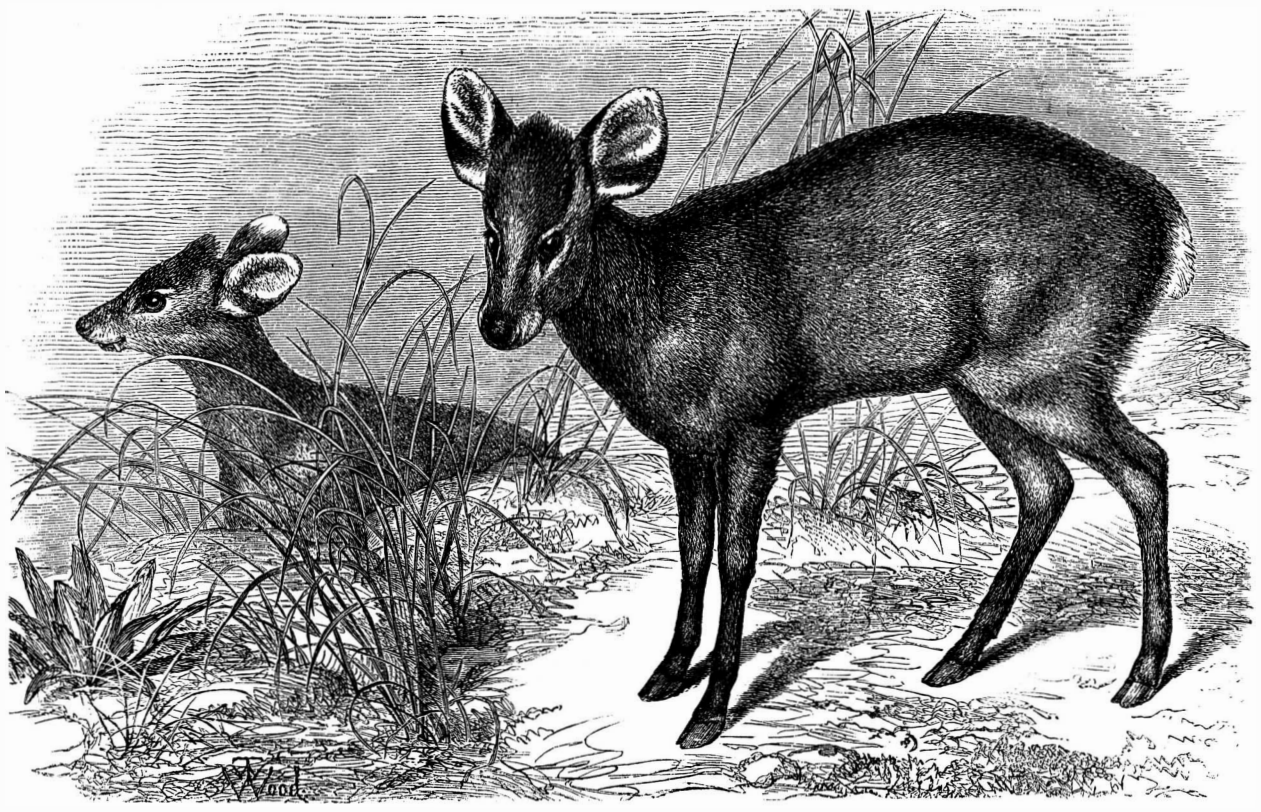
NEW CHINESE DEER.

Towards the end of 1873, Michie, an English naturalist in China, discovered in the mountains, near Ningpo, a new species of deer, termed by the inhabitants the *shanyang*. The skin of the animal being sent to England, it was there carefully studied, and Mr. Swinhoe, a well known zoölogist, declared not only the species to be new, but that the animal belonged to a new generic type, different from any yet known. He applied to it the name *lophotragus Michianus*, the first word having reference to the peculiar tuft of hair on the animal's head, and the last referring to the name of the discoverer. A living deer has lately been placed in the Zoölogical Gardens, London, and the identity of the genus, with that of the *elaphodus* discovered by Abbé David in the mountains of the principality of Moupin, has been determined.

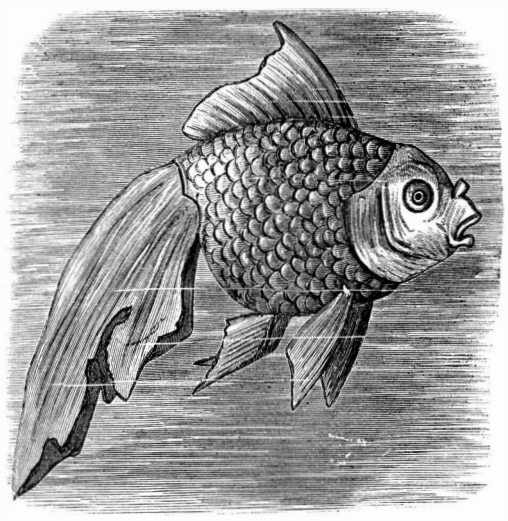


CHINESE DEER.

The *lophotragus* is a deer of small size, resembling the *hydropotes* or Chinese aquatic deer. Its hight is about 21 inches. On the summit of the head the hair forms a tuft about 1·5 inches in length, which is slightly inclined rearward between the ears, presenting a very singular aspect. By separating this tuft with the fingers, two bony protuberances may be recognized, starting from the skull; but no genuine horns can be found, nor have any appeared in the specimens examined. The upper jaw has two canine teeth, which extend past the lip and protrude from each side of the mouth. The eyes are large and expressive, the lachrymal forsæ being nearly an inch in length. The nostrils are confluent with the upper lip. The color of the skin is a blackish brown, which becomes very dark on the forehead, the tuft, the rear of the ears, the dorsal line, and on the outer sides of the legs, but which lightens considerably on the belly. Insides of the ears are white, covered by black bands. There are also two white bands near the mouth. Our engraving affords an excellent idea of the general characteristics of the animal.

CURIOUS FISH AT THE NEW YORK AQUARIUM.

In the accompanying illustrations are represented three



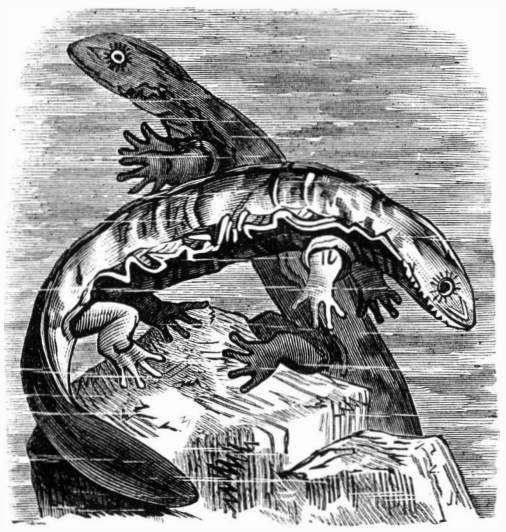
remarkable creatures which have recently been added to the New York Aquarium. The first is the

JAPANESE KINGIYO,

a fish which, apart from its great beauty, possesses an exceptional interest in that it is one of the most curious results attained by the process of artificial selection carried on over a long period of time. The animal appears to belong to the carp species, and possesses the brilliant color of the gold fish. The body, however, is almost oval, and the belly is very protuberant. Forming an exquisite contrast with the deep golden red of the body are the fins and tail, which seem to be pure, pearly white, silky membranes, edged with a delicate fringe. The tail at rest is canopy-shaped; but as the fish moves, it floats into the most graceful undulations, reminding one of a filmy cloud or curling smoke wreath. It is hardly possible to divine by what series of steps this wonderful finny creation was produced. No naturalist would hesitate an instant in classing it under a new species, were it discovered in a wild state; but the fact that it is an artificial production, obtained from monstrosities or sports of well known types, now forbids such classification, and at the same time renders the animal living evidence in favor of the evolutionary hypothesis as advocated by Darwin. There are but very few kingiyos in this country at the present time. Eighty-eight constituted the first lot brought from Japan not long since, but of these all but seven died during the voyage, or shortly after. The survivors were successfully carried to Baltimore, and during the last summer they spawned, the result being about fifty young fry, which exhibit all the peculiarities of the originals. It is the intention of the owner, when he has a sufficient stock, to donate them among persons who will take an interest in them and carefully raise them. Meanwhile Mr. W. S. Ward, the naturalist of the aquarium, has taken measures to apply and test the Oriental methods whereby this curious animal was produced; and the aid of the most improved piscicultural appliances will be invoked during a series of experiments intended to produce still more curious fish as the result of special culture. In our second engraving is represented the

ALLEGHANY HELL-BENDER,

or *menopoma Alleghaniensis*, an exceedingly ugly half lizard, half fish, found in the Alleghany river and other tributaries of the Ohio. Mr. A. R. Grote records in the *American Journal of Science* the interesting fact that this animal sheds a transparent membrane, which he believes to be the exterior layer of the skin. While observing one in the aquarium of the Buffalo Society of Natural Sciences, an almost complete skin, all the feet and toes being readily perceived, was seen floating in the water; and later the creature was discovered in the act of swallowing his former covering, a practice which has also been observed in the toad. In a recent communication Mr. Grote describes this operation of shedding the skin, from which we learn that this thin and transparent membrane is first seen to loosen and separate from the entire surface of the body, appearing at this stage like an envelope or glove in which the animal is contained. By a number of wide gapings, during which the mouth is opened to the fullest extent, the skin is parted about the lips, and then commences to fold backward from the head. Convulsive and undulating movements with the body and fore legs are employed to extract these from the loose skin. The skin then readily falls backward, as the animal crawls forward and out of it, until the hind legs are reached, when the menopoma turns round upon itself, and, taking the skin in its mouth, pulls it over the legs and tail. The operation reminds one of taking off clothes. The cast-off skin is retained in the mouth and finally swallowed. The operation is quickly performed. The visitor who watches the menopoma will observe a swaying motion of the body; this action is not yet fully accounted for, though it is possible that



it is connected with the animal's desire to rid himself of his ugly skin.

A female hell-bender, opened on the 21st of August, contained well developed eggs attached by a membrane to the ovary. These eggs are laid in a connected string, and are deposited along the muddy banks of the river. At this time there is a change in the external appearance of the creature. The tail broadens, and there is a plaited extension of the skin along the sides of the body.

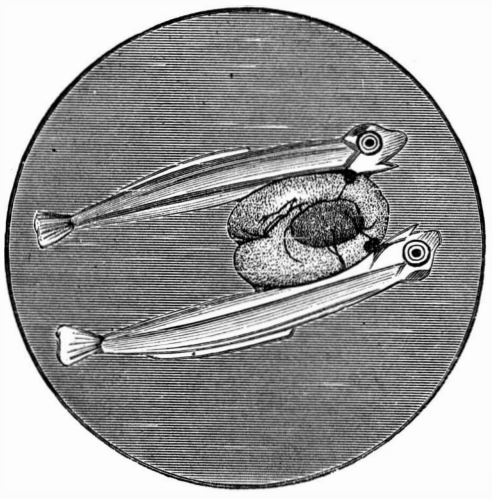
The menopoma furnishes a connecting link between the fish and lizards in the chain of evolution. On the fish side the menopoma is a higher development than the *lepidosiren* or legged fish, while it ranks lower in the scale than the amphibious axolotl.

THE TWIN SALMON,

or "salmonese twins," as some witty individual has termed them, are represented in our third engraving. The two fish were hatched from a single egg; the two bodies are attached to one sac, but each fish is perfect in itself. The connecting vesicle is filled with oil globules, arteries, and veins; and it was expected that a microscopic examination would discover a diaphragm separating the circulation into distinct systems. The closest scrutiny, however, fails to discover this wall, and the circulatory systems appear so so intimately connected that the blood flows freely from one body to the other, impelled, however, by two hearts.

Mr. Mather is of the opinion that there is but little chance of their living after the absorption of the sac; for if they survive till that time, the abdomens will still be joined by the membrane of the sac, and, being thus compelled to swim on their sides, great difficulty will be experienced in obtaining food. In this instance, however, a careful system of artificial feeding will be adopted in case the pair reach an age when they will need such nourishment. From the extended observations of Mr. Mather, it appears that these deformities are quite frequent in the salmon family, which includes the trout; and in hatching one hundred thousand eggs, there may be from three to five hundred abnormal specimens, comprising crooked backs and twisted heads and tails; and in some instances two or even three heads are attached to one body.

We are indebted to Mr. W. S. Ward and to the *New York Aquarium Journal*, an excellent little paper published at



the aquarium and devoted to popularizing scientific knowledge concerning the fish, for the engravings and facts presented.

The First Sound Telegraph.

The project at present under consideration in England, of establishing a line of telegraph across the African continent from the Cape of Good Hope, reminds us of the curious fact, not generally known, we believe, that the earliest system of telegraphy for signaling over long distances originated among the African negroes. It is still more remarkable that the means used were telephonic, and the signals were read by sound, and not by the eye, as in the case of the semaphore or other early signaling devices. The "elliembic," as the instrument used is termed, is still in existence, and has been in use from time immemorial in the Cameroons country, on the west coast of Africa. By the sounds produced on striking it, the natives carry on conversation with great rapidity and at several miles distance. The noises are made to produce a perfect and distinct language, as intelligible to the operator as that uttered by the human voice.

M. Gustave Delvigne, who died at Toulon, was the inventor of the explosive bullet and the rifled gun barrel bearing his name.

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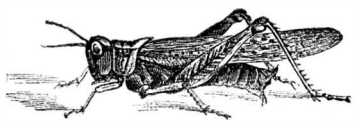
LOCUST FLIGHTS EAST OF THE MISSISSIPPI.

BY PROFESSOR C. V. RILEY.

To the unscientific mind there are few things more difficult of apprehension than that species, whether of plants or animals, should be limited in geographical range to areas not separated from the rest of the country by any very marked barriers or by visible demarcations. Yet it is a fact well known to every naturalist: and the geographical distribution of species forms at once one of the most interesting and one of the most important studies in natural history. Some species have a very limited, others a very wide, range; and while in the course of time—in the lapse of centuries or ages—the limits have altered in the past and will alter in the future, they are, for all practical purposes, permanent in present time. These limits may in fact, for the purpose of illustration, be likened to those which separate different nations. Though frequently divided by purely imaginary lines, the nations of Europe, with their peculiar customs and languages, are well defined. Along the borders where two nations join, there is sometimes more or less commingling; at other times the line of demarkation is abrupt; and in no case could emigrants from the one long perpetuate their peculiarities unchanged in the midst of the other. Yet in the battle of nations the lines have changed, and the map of Europe has often been remodeled. So it is with species. On borders of the areas not abruptly defined, to which species are limited, there is more or less modification from the typical characters and habits; while in the struggle of species for supremacy, the limits may vary in the course of time. The difference is that the boundaries of nations result from human rather than natural agencies, while those of species result mostly from the latter, and are therefore more permanent. I found some difficulty, at the late conference of governors at Omaha to consider the locust problem, in satisfying those present that the Rocky Mountain locust could not permanently thrive south of the 44th parallel or east of the 100th meridian, and that there was no danger of its ever extending so as to do serious damage east of a line drawn a little west of the center of Iowa. They could not see what there was to prevent the pest from overrunning the whole country, and thought that Congress should be appealed to, not alone on behalf of the country that has suffered from its ravages, but also of the whole country that is threatened therefrom. In my last two reports I have discussed the native home of the species, and the conditions which prevent its permanent settlement in the country to which it is not native. Briefly, the species is at home and can come to perfection only in the high and dry regions of the northwest, where the winters are long and cold, and the summers short; and whenever it migrates and oversweeps the country to the south or southeast, in which it is not indigenous, the changed conditions are such that the first generation hatched out in that, to it, unnatural climate either forsakes it on the wing, or perishes from debility, disease, and general deterioration. On the soundness of this conclusion depends the future welfare of most of the more fertile States between the Mississippi and the mountains; and Science, as well as past experience, shows it to be sound. Upon this hypothesis the people, of nearly the whole country so scourged during the year, and so threatened next spring, may console themselves that the evil is but temporary: they may have to fight their tiny foe most desperately next spring, but they have also the assurance that, even if he prove master of the field, he will vacate in time to allow of good crops of some of the staples, and that he may not return again for years. On the other hypothesis, for which there is only apparent and no real reason, ruin stares them inevitably in the face.



ROCKY MOUNTAIN LOCUST.

The causes which limit the eastward flight of the winged swarms that come from the northwest are, with the majority of people, still more difficult to appreciate, for most persons can see no reason why a swarm that overruns the western portions of Minnesota, Iowa, and Missouri should not extend to the eastern borders of the same States, or into Illinois, Indiana, Ohio, and eastward. Without discussing some of the more occult climatic influences that bear on the belief that they never will, the principal arguments rest in the facts, that: 1. The power of flight of any insect that has a limited winged existence must somewhere find a limit. 2. That all past experience has shown that *caloptenus spretus* has never extended in a general way beyond the limit indicated; and, 3, that, as long as the present average conditions of wind and climate prevail, it is reasonable to suppose it never will.

One of the principal difficulties in the way of a proper apprehension of these facts is found in the failure of the popular mind to properly discriminate between species. The ordinary newspaper writer talks of *the* grasshopper, or *the* locust, as though, all over the country and all over the world, there was but one and the same species. One of the governors present at the conference referred to was at first fully of the belief that our Rocky Mountain pest came all the way from Asia. In the case of this destructive species, even some entomologists have added to the difficulty by erroneously claiming that it is common all over the country, to the Atlantic.

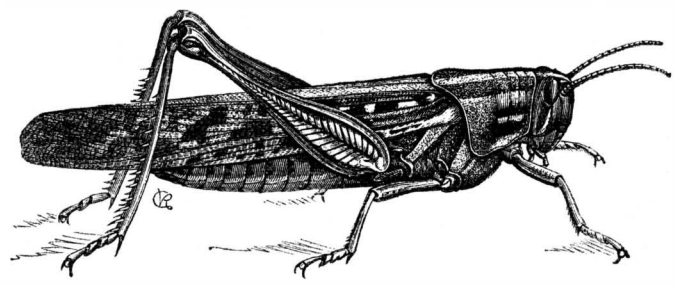
The above thoughts are suggested by the following reports that have just met my eye in the Cincinnati *Gazette* of October 24, from Dayton, Middleton, and Hamilton, respectively:

"The advent of Kansas grasshoppers, over Sunday and until Monday evening, in great numbers throughout this city is a most remarkable incident. They were found early on Sunday morning, and left, as suddenly as they came, on Monday evening."

"A shower of mammoth grasshoppers came down upon our town and vicinity on Saturday night. We have never seen such large ones before, and we understand from old citizens that they are entire strangers in this part of the country. We saw a boy have a string tied to two of them (which were as long as a man's finger) trying to drive them, and he succeeded pretty well."

"A flock of grasshoppers alighted in Hamilton about 11 o'clock on Saturday night, from the northwest. Those that were not drowned in the river, or killed by the heavy rain, were probably gobbled up before Sunday night by the chickens."

Such reports as these very naturally confirm the unscientific in their idea that the locust plague of the West, or so-called "Kansas grasshopper," has overstepped the limits entomology prescribes to it, and is upsetting the conclusions of Science. The same swarm passed over Oxford in the same State, in a southwesterly direction; and fortunately that veteran and well known apiarian, the Rev. L. L. Lanstroth, who has not forgotten to be a close observer, had specimens sent to me. They prove to be the American acridium, *acridium Americanum*. As stated in my 8th report, it is our largest and most elegant locust, the prevailing color being dark brown, with a broad, pale yellowish line along the middle of the back when the wings are closed The rest of the body is marked with deep brown, verging to black, with pale reddish brown, and with whitish, or greenish yellow: the front wings being prettily mottled, the hind wings very faintly greenish with brown veins, and the hind shanks generally coral red with black-tipped, white



AMERICAN ACRIDIUM.

spines. The species is quite variable in color, size, and marks, and several of the varieties have been described as distinct species by the species grinders. It has a wide range, hibernates in the winged condition, and differs not only in size and habit from the Rocky Mountain locust, but entomologically is as widely separated from it as is a sheep from a cow.

It is a species common over the country every year, and during exceptional years becomes excessively numerous, and acquires the migrating habit, its wings being long and well adapted to flying. It has been very abundant in the present year; and toward the end of July, while in the unfledged condition, did an immense amount of damage to the cotton and other crops of Georgia and South Carolina. The papers were full of graphic accounts of their destruction, and not only editors very generally took it for granted that they had to do with the western *spretus*, but Mr. T. P. Janes, Commissioner of Agriculture for Georgia, in his circular No. 27, supposed they were the same. Specimens which he subsequently sent me, however, revealed at once their true character.

In September, 1875, large swarms of locusts passed over Illinois, and those who were bent on the idea that there was no reason why that State should not be overrun with the Rocky Mountain locust found apparent justification for their views in the said swarms. Yet these proved to be composed of three species*, indigenous to Illinois and every year common there; and after settling they did no harm, and nothing was heard of their progeny the following spring—all which would have been very different had it been a question of the western *spretus*.

The damage done by some of the more common locusts that occur over the country is sometimes very great, especially during hot dry years. In some of the New England States their ravages have, in restricted localities, fairly equaled those of the voracious *spretus* of the West. But while a few of them, under exceptional circumstances, develop the migratory habit, they none of them ever have compared, and in all probability never will compare, with *caloptenus spretus* in the vastness of its migrations and in its immense power for injury over extensive areas. In economic entomology, discrimination between species is very important, and the lack of it often leads to most erroneous conclusions. Whenever we hear of locust flights east of the Mississippi we may rest satisfied that they are not of our Rocky Mountain pest, and are, comparatively, harmless.

Manhattan, Kan.

*The differential locust (*caloptenus differentialis*) the Atlantic locust (*caloptenus Atlantis*) and the red-legged locust (*caloptenus femur rubrum*).

Asbestos.—Its History and Uses.

Mr. C. E. Foster has compiled, for the *American Exchange and Review*, the following interesting history of the application of asbestos in the practical arts:

The daily increasing importance of asbestos in connection with packings, bearings for journals, coverings for boilers, and similar purposes, has directed attention to other applications and uses of this material, and to the patents under which exclusive rights to its employment are claimed. Being a natural substance, long known as a possible substitute for animal and vegetable fibers, and its refractory and lubricating properties recognized for hundreds of years as its peculiar characteristics, it would seem improbable that any exclusive proprietorship, based on the utilization of these properties, could be claimed or acknowledged at this late day; yet it is by no means uncommon to find advertisements implying the right in some party to the sole use of asbestos for this or that purpose, or to find that capitalists have been induced to invest their money in the experimental manufacture of asbestos products, to be protected under the patent laws.

Asbestos, or amianthus, is a mineral of a white or greenish white color, found in dense heavy blocks. It is capable of being divided into fibers of greater or less fineness and length, resembling hair silk; it is smooth and unctuous to the touch, like plumbago; these qualities are available for lubricating or anti-friction purposes. The mineral is extensively distributed, but much of it is coarse, discolored, or in a disintegrated condition, which renders it unserviceable for any purposes to which asbestos has yet been applied. The finest beds are in Corsica and Italy, but a very fair article is found extensively in Canada, Pennsylvania, Maryland, Virginia, and other places. Efforts to utilize this mineral were early made in the historic period, and one of the first applications was in the manufacture of incombustible fabric. For this purpose vegetable filaments were combined with the mineral fiber, to give strength and consistence during manipulation, the vegetable fiber being burned away after the formation of the fabric. Notwithstanding this fact, the combination of asbestos and animal or vegetable fiber has constituted the basis of many patents, some of which are in existence while others have expired. An English patent, No. 145, for the year 1857, describes a lamp wick of silk and asbestos woven together. Prior patents describe wicks wholly of asbestos; and a latter patent, No. 2,647, for 1865, describes the plaiting of asbestos in a braiding machine, and also felting it or weaving it into ordinary fabric, to be used for lamp wicks. As a fabric, asbestos was once used in the manufacture of shrouds. One of the earliest applications was in the form of paper, and the efforts to render it available for this purpose have been most persevering and unremitted to the present time. An early description of the mode of making asbestos pulp for paper is contained in an English patent, No. 1413, for the year 1853, the process consisting of boiling the mineral, dividing the fibers, and mixing alum therewith. Advantage was early taken of the non-conducting qualities of asbestos in the construction of safes—a reference to its use for this purpose being made in an English patent of 1834, No. 6,555; but it was not until 1870 that it was applied as a non-conductor in refrigerators, when F. Hyatt obtained a United States patent for a refrigerating car. Being flexible, non-combustible, and a natural lubricant, its employment as a packing for pistons and piston rods, joints, and pump plungers naturally resulted. Its adaptation for such purposes is fully set forth in a United States patent for steam engines, obtained by Israel Jennings in 1828. Notwithstanding this fact, several existing United States patents have claims for the use of asbestos for packings and joints, while others claim imparting to it a rope form, for packings, which is clearly described by Jennings. Other patents have been granted for the application of asbestos to journals or bearings, notwithstanding the existence of Jennings' patent, and also of an English patent, No. 2,048, of 1853, for a lubricating combination of asbestos, quicksilver, fats, and oils. A combination of asbestos, soapstone, and cotton is described in P. S. Devlan's patent of August 22, 1865. C. A. Steven's patent of March 29, 1870, claims the insertion of a cord in a rope packing of asbestos to strengthen it; and Morris Bottticher's patent of October 4, 1864, refers to the use of the mineral for packing in a loose mass of fiber. A combination of asbestos with plumbago and iron filings is claimed in P. J. Kelly's patent of November 8, 1870; and a combination of asbestos and clay in Lanbereau's English patent, No. 213, for the year 1859, where the mixture is shown molded into bricks or forms for lining fire boxes. Combined with felt or pulp, and made into sheets, asbestos has been for some time applied for roofing, under H. W. Johns' patents of 1868; in 1866 it was applied to carbureters, as specified in J. A. Bassett's patent of September 18. William Beschke patented August 14, 1866, its use in lamps, to absorb the oil and prevent its distribution in case of fracture of the lamp; and the English patent, No. 362, for the year 1865, is based on the insulating property of asbestos, and its use as a non-conducting material in electrical apparatus.

Railroad Accident.

Reeently at North Concord, N. H., two ladies attempted to drive across a railroad track, after the train which had delayed their passage had gone by. They failed to notice a locomotive following closely in the rear of the cars, and consequently were run into and killed. This kind of accident, now becoming altogether too common, is chargeable directly to the negligence of railroad companies, and it will probably continue to occur until railroad crossings at grade are prohibited by law. Experience shows that gatekeepers and signal men, however vigilant, do not prevent people from suddenly driving or stepping upon the track. In England a crossing at grade is a rarity; and in this city, public outcry compelled the sinking of the tracks which pass through Fourth avenue.

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CENTENNIAL NOTES.

In the English department was exhibited a model of Whitwell's fire brick

HOT BLAST STOVE

for raising the temperature in hot blast furnaces. The usual method of building these stoves has been to construct them of cast iron pipes, which, if the temperature were raised to 1,200° Fah., usually were burned out. In Whitwell's system, the heating surface is constructed entirely of fire brick, which are so laid up that the heated gases are forced through a series of flues, alternately from top to bottom of the stove, until the whole mass of brickwork is raised to a high degree of heat; the stoves will stand a temperature of 2,000° Fah., without damage. Three stoves are used with a furnace, two of which are being heated while the third is having the air forced through it into the furnace. The advantages claimed are that the greatest economy of fuel is secured, nearly the whole heat being utilized, several hundredweights of fuel per tun of iron being saved: that they last a long time with but trifling expense for repairs, and that they are easily cleaned. The estimate of saving in cost of producing iron is 33 per cent.

Among the

ENGLISH CARPETS

we noted several magnificent patterns in Wilton and Axminster. The difference between these very costly kinds of floor covering is not generally understood. Wiltons are Brussels carpets with the loops cut before the wire is drawn out; they are generally closer woven, so the pile, or cut ends, may be packed closer together. The colors of these carpets go clear through to the back, but are only seen there in straight lines. The Axminster carpets, on the contrary, show not only the colors but the pattern on the back, though the pile is only on the right side. Nor is there any limit to the number of colors which may be used. They do not necessarily repeat themselves in any regular order, nor are the patterns repeated, either in regular order or at all, except at the will of the manufacturer. Each carpet has an individuality; but to accomplish these results there is less of machine work and more head and hand labor required. The process is a slow one, but the result may be seen in carpets with a pile of five eighths of an inch high, and so close that it cannot be separated to show the warp. Such carpets endure a great deal of hard service, and when the pile has grown uneven it can be brightened up four or five times by shaving it with a machine made for that purpose.

What is called "patent" Axminster is woven in the loom, and the color does not appear on the back at all. On the surface it would be difficult to tell in what the difference consists. It can be made for a much less cost than the real Axminster, which requires each thread and color to be tied separately by hand to the warp. This is so great a labor that fully three months are required to make a carpet twenty feet square. So great is the difference that the best patent Axminsters can be furnished for much less than half the cheapest real Axminster; yet there seems to be no reason why the patent carpets should not wear as long as the real.

A new method of

ARTISTIC POTTERY WORK

is called the *pâte sur pâte*, or paste upon paste process. The design is raised in white china clay upon a dark ground, the result being a most perfect imitation of a cameo in onyx or agate. White china clay is reduced to a liquid state; and with it this condition, the artist, with a thin brush, paints the design upon the plate, vase, or other object, putting on coat after coat of the liquid china until the desired thickness is obtained in each of the parts. Before burning, the china is opaque, but becomes translucent after burning. The artist, therefore, to properly distribute the light and shade, must put on the material thin or thick, and do this, too, without being able to judge of the effect by the eye; nor can any error of judgment be corrected by subsequent retouchings, as nothing can be done after the piece has been burned.

A model was exhibited by the Erie Railway Company of the famous

WOODEN BRIDGE

that carried that line over the Genesee river at Portage: a structure so arranged that each piece of timber could be separately removed and replaced by a fresh piece without disturbing the strength of the work as a whole. The bridge was further distinguished by the fact that it was the highest wooden bridge in the world, the rails being 235 feet above the level of the water. It was opened to travel August 2, 1852, and was destroyed by fire on May 6, 1875. Hanging beside the model is a photograph of the iron bridge that has taken its place, an airy structure looking like a spider's web outlined against the sky. Not the least wonderful fact in connection with the new bridge was the rapidity with which it was erected, the line being reopened for travel on the 31st of the following July. But this was slow in comparison with what was accomplished (almost simultaneously) by the same company in rebuilding the bridge carrying their metals across the Delaware, three miles above Port Jervis. The bridge comprehended one deck span of 160 feet, three deck spans of 150 feet each, and a span over the Delaware and Hudson canal. The four deck spans were swept away by the ice on the night of March 17, 1875. On the 26th of the following April the new bridge, of iron, double track, was complete and put into service, having been built in just forty days. Another instance of quick work was in the case of the trestle of 780 feet long and 90 feet high, thrown across the Chattahoochie in four and a half days, in August, 1864, by the Construction Corps of the U. S. Military R. R., under the direction of Engineer W. W. Wright. But in this case the piers were standing—the bridge had been burned by the rebels—and the structure was of a temporary character.

In the Tasmanian section a stuffed skin of that wonderful and incomprehensible creature known as the

PLATYPUS OR ORNITHORHYNCHUS,

was displayed. The platypus is a fur-bearing animal, shaped much like a large duck; it has a duck bill and webbed feet, the web extending over the toes. The male has a spur like a rooster on his hind feet; back of the spur is a gland filled with poisonous matter, but the poison is not necessarily fatal. It has the fur and tail of a beaver; small black eyes like a mole; a pouch for carrying the young, like a kangaroo; its tongue is split and forked like a snake's. It lives on vegetable matter, and is amphibious, living, like the beaver, in or out of the water. In its anatomy, it has a wishbone, like a chicken, and in swimming the motions are the same as those of a bird in flying. Naturalists have been inclined to call it a bird, or at least oviparous, producing its young by eggs, but, unfortunately, the accounts of finding the eggs are too conflicting. Some men say they have seen the eggs, one man strengthening his assertion by saying he had eaten them for his breakfast. The young have been seen, evidently when but a few hours old; but no eggs have been found in the runs or holes near the water, which the platypus lives in, like a musk rat. Further than this, the natives say that this platypus does not lay eggs, and their habits of observation ought to make them good authorities on this point. A naturalist, who had dissected one of these animals, claims to have found mammary glands, which would strengthen the belief that the platypus is a beast, but sufficient evidence on this point has not yet been obtained.

In the French milling exhibits was a

BURR STONE MILL

for bolting the flour as it is ground. This consists of a number of fine wire sieves, arranged like rays on the surface of the millstone, through which the flour falls as it is ground, its passage being facilitated by means of a revolving hammer, which jars each sieve. Some of this flour is very fine, but a large portion of it must be reground. What is called high grinding is adopted with this style of stone: that is, the millstones are more widely separated, the husks and fine flour are removed in the usual way, and a rather coarse middlings is left, which, while possessing the most nutritious qualities of the wheat, is too dark and coarse. This is afterwards run through another pair of stones, which grind it into fine flour.

THE SALE OF THE BUILDINGS.

Twenty-four buildings belonging to the Centennial Board of Finance, besides a dozen structures of varying dimensions, the property of individuals, were sold at public auction on November 30. The Main Building, which cost about $1,600,000, was sold to the Permanent Exhibition Company for $250,000. The other structures brought even a less percentage of their original cost. The principal sums realized were as follows: Two Mineral Annexes, cost $19,000, sold for $1,000; Carriage Building, cost $55,000, selling price $4,100; Art Annexe, cost $110,000, selling price $3,500; Photographic Hall, cost $23,000, selling price $1,000; Judges' Hall, cost $30,000, selling price $1,500; Shoe and Leather Building, cost $30,750, selling price $3,000; Agricultural Hall, cost $275,000, selling price $13,100. The remainder of the buildings sold at about similar rates, and the work of removing them will at once begin. The structures left are the Main Building, Machinery and Memorial Halls, German Pavilion, English dwellings, and Horticultural Hall. The Woman's Pavilion, which it was at first proposed to sell, is now to be reserved as a memorial. The Japanese Building will be sold, and the future disposition of the United States Building is not yet announced.

THE OCCUPATIONS AND HEALTH OF THE MERCANTILE CLASSES.

Out of every thousand men engaged in mercantile employments, examined by the enrolment surgeons during the late war between the States, five hundred and twenty were fit for military service: forty more than were furnished per thousand of professional men, and forty-four less than were got from the same number of skilled mechanics. Rated according to the military capacity of their members, the different mercantile occupations stand in the following order: Tobacconists, furnishing 623 per thousand; clerks, 585; peddlers, 580; bar keepers, 500; liquor dealers, 471; grocers, 451; innkeepers, 420; agents, 416; merchants, 392; brokers, 329.

Bar keepers we have transferred from the list of unskilled workmen for comparison with liquor dealers and tobacconists. It is one of the most surprising results of this examination to find those engaged in handling tobacco and spirituous liquors so exceptionally healthy. They not only stand especially well among the mercantile classes, but much better than the members of the higher professions. And curiously, they would seem to be specially free from the disorders of the digestive system and the nervous system which certain popular theories would make inseparable from their employment.

The general health of tobacconists was even better than the foregoing figures would indicate, since 86 per thousand were rejected for conditions not necessarily connected with disease, chiefly for deficiencies in age and size, and 26 for local injuries and deformities, in which the selective action of a light occupation is apparent. In syphilis their record is bad: 16 per thousand, or twice as many as among the clergy, but only half as many as among bar keepers. Their chief diseases are of the digestive system, causing the rejection of 65 per thousand (almost wholly from loss of teeth and hernia); diseases of the circulatory system 43 (mainly heart disease); lung diseases 34; diseases of eye and ear 30, and of organs of locomotion 41. For diseases of the nervous system, they stand about with regular merchants and clerks. They are comparatively free from obesity, and but little troubled with chronic rheumatism.

Clerks were disabled chiefly by conditions not necessarily connected with disease, 76; local injuries 33; diseases of the digestive system (mainly hernia and loss of teeth) 106; diseases of the organs of locomotion 30; of the eye and ear 32; of the circulatory system 44; of the lungs 33. Peddlers rank next to clerks, and show for the most part disabilities not directly attributable to their work; for example, 50 per thousand rejected for conditions not necessarily associated with disease; 40 for loss of teeth; 51 for wounds, fractures, etc.; and 33 for diseases of eye and ear. For inguinal hernia, attributable in many instances no doubt to lifting heavy packs, 39 in the thousand were rejected; 17 for diseases of the joints, and 7 for spinal curvature, largely due, possibly, to the just mentioned cause. Consumption disabled 42 per thousand, and diseases of the circulatory system 48.

Bar keepers and liquor dealers stand near together in military efficiency, high compared with the professional classes, but low as compared with mechanics and laborers. Bar keepers suffer more than liquor dealers from diseases of the digestive system (133 to 40), but less from disorders of the circulatory system (52 to 129); in consumption and disorders of the nervous system their record is good, 21 to the thousand. Liquor dealers suffer more than any other mercantile class from chronic rheumatism, and from diseases of the eye and of the organs of locomotion. Grocers fall below the mean of the mercantile classes. Loss of teeth caused the rejection of 86 per thousand, and hernia, 69. For all disorders of the digestive system, the rejections were 190 per thousand. Disorders of the circulatory system come next, 67 per thousand. For disorders of the nervous system they stand among the worst, 21 per thousand being rejected for this reason; for consumption 35; diseases of the eye and ear 38; of the organs of locomotion 52; for conditions not necessarily associated with disease 27; for injuries, etc., 55.

Innkeepers are a grade lower than grocers in general health, and lead the van in obesity, for which ten per thousand were rejected: the same fault causing the rejection of five grocers and seven agents per thousand, all others of the mercantile class being nearly if not quite free from it. Innkeepers stand universally high also for loss of teeth, 93, and for hernia 48. For all diseases of the digestive system, 223 per thousand were rejected. For diseases of the nervous system, they stand higher than lawyers, and are exceeded only by agents, watchmen, ostlers, and unclassified "other occupations." For diseases of the eye and ear they stand third (44 per thousand), the ratio for brokers being 50, and for liquor dealers 57. They also stand next to brokers and above all others for disabilities arising from wounds, fractures, and malformations.

Agents suffer more than any other mercantile men from lung diseases, 53 per thousand, from diseases of the nervous system 29, and insanity 9; they are exceeded only by merchants in diseases of the digestive system, 189; and are afflicted more than the average by diseases of the circulatory system, 51. As regards syphilis they rank with clergymen, doctors, and public officers. For diseases of the eye and ear, 39 in the thousand were rejected; for diseases of the organs of locomotion 51; for conditions not necessarily associated with disease 49, and for local injuries and malformations 69.

Lowest in military capacity among mercantile men are merchants and brokers. Their disqualifying disabilities present some curious contrasts. For instance, more than twice as many brokers as merchants were rejected for wounds, fractures, malformations, and the like (120 to 56); and nearly fifty per cent more for conditions not necessarily associated with disease (76 to 56). On the other hand nearly three times as many merchants as brokers were rejected for diseases of the organs of locomotion (55 to 19). Evidently a larger proportion of men, unfit for severe labor because of injuries, malformations of hands and feet, and deficiencies in size and strength, adopt the broker's calling. More merchants are disqualified because of hernia and loss of teeth, fewer for disorders of the circulatory system (60 to 82); more for insanity and nervous derangement (13 to 9); and more for consumption (48 to 19). In general health and physical capacity, merchants and brokers rank with physicians, clergymen, and public officers, and were capable of furnishing for the army only about half as many men per thousand as the mass of unskilled laborers. In disorders of the digestive system, they exceeded all except innkeepers (brokers 177, merchants 218). In diseases of the circulatory system, the brokers came next to the liquor dealers (82), the merchants next to grocers (60). The brokers stood lowest in consumption, the merchants next the highest. In chronic rheumatism, the brokers stood second to liquor dealers, and the merchants come next, on a level with agents.

Wanted, A Tiger Exterminator.

During the year 1872 a census was taken in India of the persons who had been killed by wild animals during the years 1868, 1869, and 1870. The total reached 38,218, of which it was found that 25,664 had died through the bites of venomous serpents, while the remaining 12,554 had nearly all been devoured by tigers. So that, for the years mentioned, Her Majesty's dusky subjects were eaten at the rate of about one every two hours. Plenty of such suggestive statistics are at hand. Official reports from Lower Bengal state that 13,400 persons in that section of the country were devoured in six years, and the destruction over the entire

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peninsula is estimated at 10,000 people a year. In 1869 one tigress blockaded a road, stopped traffic thereon for several weeks, and slaughtered 127 victims. During two previous years she killed 108 people.

Nor do the feline damages end here. We have further statistics which show that for each person killed sixty head of cattle are destroyed, and this aggregates a money loss of about $5,000,000 yearly. The terror produced by a tiger's ravages often desolates whole villages. At one time, in one of the Central Indian provinces, thirteen villages and a cultivated area of 250 square miles were simultaneously abandoned, owing to the visitation of a band of tigers.

These facts have been laid before the English House of Lords, and the government has been asked to take speedy measures to check the present rate of carnage. Since the Sepoy rebellion and the consequent disarmament of the natives, it is reported that the tigers have greatly increased in numbers. In localities where they abound, there are bands of hunters who receive a bounty from the government for every tiger killed; but these men never shoot a tiger unless the animal has acquired considerable celebrity by his exploits. They thus pocket a much higher reward, owing to the authorities setting a variable scale on the head of the beast, according to his age and voracity. Meanwhile the English papers are urging immediate action. The *Times* says that: "It is frightful to think that, in the middle of the nineteenth century, with all the improved engines which man has invented to destroy his kind, a considerable number of the subjects of Her Majesty are exposed, just as if it were a form of natural death, to be devoured on their very thresholds by savage beasts."

Here is a chance now for some enterprising person to undertake the extermination of the Indian tigers by contract. He might contrive an ironclad steam carriage, capable of propelling itself through jungles, and having apparatus for throwing jets of boiling water or hot steam into inaccessible places, to dislodge the animals, and a battery of Gatling guns wherewith to salute their appearance. Tigers are not invulnerable; but to engage them, even on elephant back, is a perilous undertaking. To destroy them from behind armor with Gatling guns and torpedoes is a much safer proceeding; and as the authorities frequently offer as high as $150 for a single animal, it might prove a remunerative venture.

PROFESSOR HUXLEY says: "The general notion of an Englishman when he gets rich is to found an estate and benefit his family. The general notion of an American, when fortunate, is to do something for the good of the people and from which benefits shall continue to flow. The latter is the nobler ambition."

A distinguished French scientist has recently died. M. Charles St. Claire-Déville was a chemist and mineralogist of great ability. He discovered amorphous and insoluble sulphur, thus showing, for the first time, a simple body in two conditions, differing not only in physical characteristics, but in essential chemical properties.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED NECK YOKE.

Frank Hannig, Lockhart, Tex.—This consists in proving the neck yoke with a central enlargement, and connecting the tube which slips on the end of the carriage pole with the yoke by means of rings having perforated ears to receive the ends of a pivoted bar, to which the pole ring or tube is swiveled.

IMPROVED AXLE LUBRICATOR.

John J. Wetmore, Shabonier, Ill.—This consists in combining an oil chamber having a close-fitting plunger with a skein having an internal longitudinal groove and side apertures communicating with the surface of the bearing.

IMPROVED HAT-BOX-BOARD CUTTING MACHINE.

William Jenkins, Newark, N. J.—The invention consists of a reciprocating carrier that feeds the block against the adjustable cutting knife to cut off the thin boards. The board is pressed in one direction against the knife by a weighted roller, and lifted by vertically movable rollers and actuating mechanism operated by the carrier when sliding in opposite directions to clear the knife.

IMPROVED DOOR SHEAVE.

George Laauwe, New Yorkcity.—These sheaves for sliding doors are so constructed that they may be easily adjusted to regulate the door so that it may be plumb, and to enable the wear to be easily taken up. The sheaves are pivoted between the arms of a V strap, which is inserted in a case; through the top of the latter a screw passes, and is so secured to the sheave strap that the sheave may be raised and lowered to adjust the door.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHURN.

Elisha A. Hewitt, Groton, Conn.—This consists of a churn with revolving bifurcated beaters and fixed side breakers, the air being admitted by a revolving fan with hollow shaft, operated by the driving mechanism.

IMPROVED CHECK ROWER.

Albert M. Black, Pawnee, Ill.—This check rower is used in connection with a planter, and is readily adjusted on the ground without necessitating the marking of the same. It consists of a cord with tags, applied at suitable distances, passing over guide pulleys and rollers at the ends of a cross bar of the planter. The dropper keeps his eye fixed on the end of the pointer, and gives a pull to the drop lever for depositing the required quantity of corn as each tag passes the end of the pointer. When the opposite side of the field is reached, the dropper takes a tension pin, with spring top hook, and drives it some distance back of the planter into the ground, passing the spring hook over the rope to retain the tension of the same. The stretching pin at the end is then taken up, and the planter turned, the rope being again drawn through the pulleys and staked down at the opposite side of the planter, which is then ready to pass back over the field, dropping the corn in the same manner as before.

IMPROVED HORSE HAY RAKE.

Amos W. Coates, Alliance, O.—This invention relates to an improvement in clearers for horse hay rakes, and is more particularly an improvement in that class of clearers which consist of a transverse bar resting upon the rake teeth and connected to each of them by staples or equivalent devices. According to this improvement, the clearer bar is supported above the rake teeth by means of forks which bear upon but two of the latter, whereby certain advantages are secured in respect to wear and friction, ease of operation of the rake, and independent action of the wire teeth.

IMPROVED HARROW.

Adolphus W. Davis, Dwight, Ill.—This improves the construction of the harrow for which letters patent were granted to the same inventor, July 13, 1875. By pushing a lever forward and then raising its rear end, the forward end of a section will be raised from the ground, and then, as the upward movement of the lever is continued, the whole section will be raised from the ground. In the same way, by drawing the lever to the rearward, and then raising its rear end, the section will be raised rear end first. As either end is raised, the other end rests upon the ground to do its required work.

IMPROVED CORN PLANTER.

Ira Houghtling, Houghton, Mich.—This invention consists in providing a corn planter with a cam shaft, disk slide, spring, arm, and spouts; also, in connecting the feeding tube slide and spring by a link that may be shortened.

IMPROVED FARM GATE.

Joseph Jennings, Jr., Wilton, Iowa.—By raising the forward end of the gate the rear end of the braces are drawn forward, and a bolt drops into notches of the bottom bar and thus holds the forward end of the gate securely at the point to which it has been raised. Devices are provided for lowering the forward end of the gate to any desired point.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PRINTING PRESS.

Willard W. W. Belknapp, Brooklyn, N. Y.—The new feature consists of a swinging platen, in combination with a vertically movable bed, and an oscillating ink-distributing mechanism. The simplicity of this apparatus renders the press less expensive, and facilitates the rapid and effective working of the same.

DEVICE FOR MAKING FACE PLATES FOR DRAWBARS.

John Green, Sunbury, Pa.—This invention relates to an improvement in the manufacture of face plates for drawbars of railway cars, and it consists in a series of tools to be used for the common end of making the said plates, which tools are employed for the successive steps of cutting out the blanks, stamping the slot and rivet holes, and bending the stamped plate into curved form: each of the tools being provided with extended handles for their convenient manipulation beneath the hammer, whereby all of the said steps of the operation are conducted under the same heat employed for forging the blank plates.

IMPROVED ROTARY ENGINE.

George C. Hale, Kansas City, Mo.—The object of this invention is to effect an improvement in that class of rotary steam engines whose case or cylinder is made to revolve around a stationary circular head or disk to which the pistons are attached. To this end the pistons proper are hinged within a stationary disk having hollow trunnions, and the cylinder revolves around it. The induction ports are in the piston heads, and the cut-off is effected by the automatic movement of the pistons themselves. Thus the necessity of supplementary steam valves is avoided, the number of working parts reduced to a minimum, and the compactness of this class of engines considerably increased.

IMPROVED MILLSTONE DRESS.

Elias N. Roeder, Quakertown, Pa.—This invention consists in dressing both stones exactly alike, with a series of tapering, leading furrows, wider at the eye than at the skirt, deep on one side and tapering to a feather edge upon the other, which feather edge is arranged radially with the center of the stones, so as to have no draft in the leading furrows, the necessary draft being supplied by the quarter furrows, which open into the leading furrows and are formed with an inclined bottom, and of a tapering shape similarly to the leading furrows.

IMPROVED MILL PICK.

Edgar F. Lemoine, Emmerton, Va.—This improvement consists in the particular means for clamping the jaws, in which a screw-threaded stem of the shank enters a female thread of the upper jaw and holds the jaws together, while guide pins prevent the jaws from turning on each other. With this means of clamping the jaws the latter do not become loose, and the blades can never become accidentally detached, as when a key is used, which latter, from the impact of the blows, is readily displaced.

IMPROVED MIDDLINGS SEPARATOR.

Edwin Slagle and John McClure Graham, Albany, Mo.—This relates to improvements in the flat, inclined, shaking flour bolt, having cloth arranged in wave-like form, for which a patent was granted to the same inventors, February 1, 1876. Seven new devices, mainly relating to improved mechanical construction, are embodied.

IMPROVED MILLSTONE DRESS.

Henry Grigg and William McElroy, Lockport, N. Y.—This invention consists in beveling the inner portion or bosom of a millstone, from a point about ten inches from the periphery down to the eye, making the space thus formed about one half inch deep at the eye. It also consists in cutting furrows from the eye outward, on a radial line from the center of the stone, to the line that defines the beveled portion, starting in a line at the eye, and increasing to the required depth at the outer edge of the beveled portion. The grooves, from this point, are tangential to a circle drawn outside of the eye, so that they have an inclination or draft of from five to eight inches. The object is to provide a millstone dress that will increase the quantity of middlings.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED GRINDING MILL.

James Madison Collier, Gadsden, Ala.—The driving belts are led to each end of the running stone, both from the countershaft, which is so located that the pull of the belts is directly against the crowding of the journals of the runner against the boxes by the grain.

IMPROVED OILER

Nelson Holmes, Ypsilanti, Mich.—This consists of an annular spring-supported piston on the rear end of the nozzle, so that, when the latter is pushed back, oil is ejected through the spout.

IMPROVED COIN COUNTER.

Aron Bernstein, Berlin, Germany.—This furnishes a reliable means to instantly detect any false or light gold coin without showing the mode or mechanism by which the same is tested. This object is obtained by allowing the gold coin to fall through a narrow opening and guide channel on to a balance or tilter, from which it will, if genuine and of full weight, roll at once, by suitable deviating mechanism, into the cash box or receptacle; but if it is not genuine, or is of short weight, it is conducted into a separate open receptacle, so as to indicate directly the lack of genuineness or full weight.

IMPROVED LUBRICATING COMPOUND.

John W. Bartlett, Moline, Ill., assignor to himself and Merven Witherell, same place.—This is a lubricating compound for car axles and other friction surfaces, which will not take fire from a hot journal. It is formed of pulverized blue stone, oil rock, carbonate of potash, chloride of lime, American soapstone, concentrated lye, golden machine oil, pure lard oil, salt, tartaric acid, and soft water.

IMPROVED CARTRIDGE-LOADING DEVICE.

Thomas P. Camp, Stoughton, Wis., assignor to himself and G. W. Wise, same place.—This is an improved device for loading the cartridge shells of breech-loading shot guns. It consists, mainly, in the arrangement of a single continuous slide, having two charging holes, which, by being moved back and forth in a race, receive the charge of powder and shot from respective powder and shot hoppers above, and deliver it to the cartridge shell below. There is a central plunger and inserting spout for the wads, and cut-off brushes in the hoppers, for brushing off and leveling the charge in the slide.

IMPROVED PESSARY.

Jonathan P. Barnett, Navasota, Tex.—This relates to an improvement upon the pessary described in patent No. 163,871, and consists mainly in the arrangement of the wings for supporting the pessary, the arms for adjusting said wings, whereby they are adapted to be folded inward, and the adjusting arms to be folded into slots formed in the tube, to which the wings are hinged.

IMPROVED BALE TIE.

James M. Pollard, New Orleans, La.—The central cross bar of the buckle is provided with a lug or projection on the under side, and the free end of the band is slotted and held up against the bar so that the lug projects into one of the slats, thereby forming the lock. The other or fast end of the band forms the spring by which the slotted end is thus held against the bar and engaged with the lug. The disengagement may therefore be readily effected by depressing the spring. The fast end of the band is so bent as to form a shoulder, which prevents the buckle being accidentally detached from the band; but the attachment and detachment of the buckle may be very easily effected when desired.

IMPROVED SCISSORS.

Amos W. Coates, Alliance, Ohio.—This is an improvement in scissors, designed particularly to adapt them to the use of little girls in cutting out their little quilt patches, doll papers, etc.: and it consists it constructing the two blades with two terminal bulbs or guards which, while permitting the perfect closing and free cutting action of the scissors, also form a guard, whether the scissors be open or shut, which prevents accidental injury to the child, and enables her to use the scissors with perfect safety to the eyes and body.

IMPROVED ANIMAL TRAP.

Cornelius Koons, York Road, Md.—This invention consists mainly in a drum-shaped two-compartment cage made of wire cloth, to the upper compartment of which access is had through a square tapering inlet formed by inwardly converging pointed wires, having suspended in the center a swinging gate composed of pointed wires which admit the access of the rats, or other animals, but prevent their escape; and it also consists in the particular construction and arrangement of the upper inlet and compartment with a lower compartment having a second inlet to receive and retain the rats caught by the first or upper compartment.

IMPROVED COMPOSITION FOR PRESERVING BOLTING CLOTH.

John Wayman, of Collinsville, Ill.—This is a compound formed of wormwood, oil of cedar, gall, and tallow, forming a paste which will keep insects away from the bolting cloth.

IMPROVED BELL TOY

John T. Rich, Middle Haddam, Conn., assignor to J. C. Clark & Co., of same place.—This improves the construction of the toy bell for which letters patent were granted to J. C. Clark, November 2, 1875, in such a way that the vibrations of the bell may be less obstructed by the mounting. The bell, consisting of a spherical perforated shell, is now secured at one side only to the axle of the carriage on which it is supported.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WASHING MACHINE.

Benjamin F. Fowler, Eau Claire, Wis.—This improved machine does its work by alternately saturating the clothes and then pressing them, to force out the water and dirt, between an upper corrugated roller and a series of smaller rollers beneath.

IMPROVED WATER FILTER.

Samuel F. Simes and Charles Tate, Philadelphia, Pa.—This invention relates to a novel construction of filter for the purification of water or other liquids, which filter is especially designed for attachment to the nose of a hydrant, but applicable also for general use in any connection whatever. The invention consists mainly in a specially prepared purifying pad formed by embodying powdered charcoal, kaolin, or other purifying material, either singly or combined, with the fiber of felt, by blowing it in during the process of the manufacture of the felt. This pad is contained in a chamber formed by two detachable caps, and is held between gratings in the same by means of a cam joint which fastens the caps, which devices also form a part of the invention.

IMPROVED STEAM COOKING KETTLE.

William G. Flanders, West Lebanon, N. H.—This is a double-chambered culinary vessel, made in detachable parts, each provided with a perforated diaphragm. The upper part has a bottom provided with a slide for closing the apertures therein, so as to regulate the admission of steam to the articles to be cooked.

NEW TEXTILE MACHINERY.

IMPROVED WARPING MACHINE.

John J. Ashworth and George Ashworth, Pendleton, England.—This invention places all the warp threads perfectly straight on the beam, prevents twisting, facilitates the weaving, simplifies the machinery, reduces labor, and economizes space in the mill. It embodies eight novel devices, all of which are of great ingenuity, but which are so combined that it is not possible to convey a clear idea of their working without the aid of drawings. There is a new registering apparatus which indicates the exact number of revolutions of the beam, while another device shows the tension of the yarn. By these the same length of yarn is wound in the same number of revolutions upon each of the succeeding sections of the beam as there is upon the first section.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

Pattern Makers can get Metallic Pattern Letters. to letter patterns of H. W. Knight, Seneca Falls, N. Y.

Wanted—A heavy first class Tenoning Machine. Address A. W. Gray's Sons, Middletown Springs, Vt.

The world-wide reputation of Asbestos Steam Pipe and Boiler Coverings, Roofing, Roof Paint, Cement for repairing roofs, etc., has induced unscrupulous persons to sell and apply worthless articles, representing them as being made of Asbestos. The use of Asbestos in these and other materials for structural and mechanical purposes is patented, and the genuine can be obtained only of H. W. Johns, 87 Maiden Lane, N. Y.

Emery Grinders, Emery Wheels, best & Cheapest. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket. R. I.

Shingle, Heading and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Chester Steel Castings Co. make castings twice as strong as malleable iron castings at about the same price. See their advertisement, page 397.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N. Y.

The best Sewing Machine in the world—Makes the Lock Stitch, the Chain Stitch, and Embroidery Stitch from two whole Spools. Agents wanted everywhere. G. L. Du Laney & Co., 744 Broadway, New York City.

D. Frisbie & Co. manufacture the Friction Pulley—Captain—best in the World. New Haven, Conn.

Slide Rest for $8 to fit any lathe. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Lansdell's Pat. Steam Syphons—Lansdell & Leng's Lever and Cam Valve. Leng & Ogden, 212 Pearl St., N. Y.

Best Bolter for Sawing Handles, Furniture Stuff, Wagon Stuff, Fence Boards, &c. Send for Circulars. Richard W. Montross, Galien, Mich.

Steel Stamps & Brass Stencils, for Marking Tools, Patents, Boxes, &c. E. H. Payn, M'f'r, Burlington, Vt.

For Specialties in Woolens, Seamless Roller Covers, Printers' Blankets, &c., address H. Waterbury & Co., Rensselaerville, Albany Co., N. Y.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheaper by comparison than any others extant. 246 Grand st., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

To Lease—The largest portion of the building corner Canal, Center, and Walker Sts., now occupied as a Billiard Manufactory and Sales Room. See advertisement in another column.

Superior Lace Leather, all Sizes, Cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Arny. 148 North 3d St., Philadelphia, Pa.

Magic Lanterns, Stereopticons, for Parlor Entertainments and Public Exhibitions. Pays well on small capital. 74 Page Catalogue free. Centennial Medal and Diploma awarded. McAllister, 49 Nassau St., N. Y.

Fire Hose, Rubber Lined Linen, also Cotton, finest quality. Eureka Fire Hose Co., 13 Barclay St., New York.

The Scientific American Supplement—Any desired back number can be had for 10 cents, at this office, or almost any news store.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co, So. Newmarket, N. H.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water Street, New York.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N. J. & C. 27, Mchy. Hall, Cent'l.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Notes & Queries

J. N. P. will find directions for making friction matches on p. 75, vol. 29.—R. J. will find directions for nickel plating on p. 235, vol. 33.—J. N. will find the article on the friction of water in pipes on p. 48, vol. 29.—C. F. can remove moles from the skin by following the directions on p. 347, vol. 32.—C. R. S. will find on p. 120, vol. 33, directions for making muslin uninflammable.—J. F., M. M., W. G. E., B. P., M. T. B., H. A., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) R. C. says: A. asserts that water has been lifted 33 feet 6 inches with a common lift pump. B. asserts that it never has been lifted higher than 32 feet. Which is right? A. Water was once raised 32 feet 11 inches by a lift pump at the Brooklyn navy yard. This is the greatest result of which we have heard.

(2) E. L. says: I have a small piece of sylvanite, said to yield $40 gold to the lb. I suppose that it also contains tellurium and silver. I have used the blowpipe upon it and melted out a large percentage of metal having a silvery appearance. How can I separate the gold from all other metals? A. Sylvanite contains 56 per cent of tellurium, 28 of gold, and 16 of silver. It frequently contains as well some antimony and lead. After complete roasting, dissolve in aqua regia; evaporate to dryness. Add a small amount of sulphuric acid, and dissolve as far as possible in water. From the concentrated solution, precipitate out the gold with a strong solution of green vitriol.

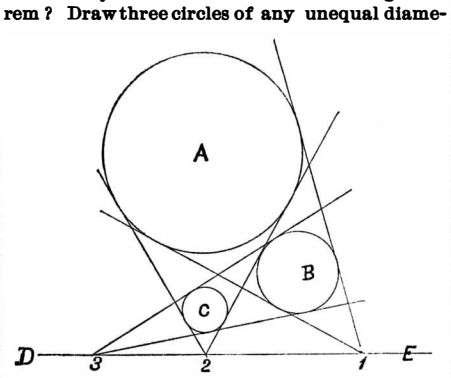
(3) A. O. W. says: I want to vulcanize rubber, and cannot get chloride of sulphur. Please give me the formula for it. A. Chloride of sulphur is obtained by passing dry chlorine gas slowly over molten sulphur, and collecting the product in a condenser. The sulphur should be heated until just at the point of volatilization, about 600° Fah. The impure chloride should be purified and freed from dissolved sulphur by redistillation. It is a reddish yellow fluid of a disagreeable odor, and boils at 280° Fah.

(4) A. C. G. asks: How can I make a composition of chalk or plaster of Paris for making molds that will not dissolve in water? And how can I take impressions or make molds in metal from natural objects? A. Molds of this character are not absolutely insoluble in water. Use 1 part of the finest chalk intimately mixed with 3 parts plaster of Paris. Place the object to be copied in a shallow tray, or other suitable vessel, cover every part of it with a thin film of olive oil, and then brush over it with a camel's hair pencil a thin cream of the finest plaster with water in order to exclude all air bubbles: when this is done, pour over it immediately, and at one motion, the proper quantity of plaster, of a somewhat thicker consistence than that first applied. Allow the plaster plenty of time to set, and, when perfectly hard, remove it carefully from the object, dry perfectly in an oven, and heat to nearly the fusing point of the metal (type metal), then pour the metal in immediately. Where the nature of the surface of the object will not allow of a direct cast being taken from the object in plaster, a thick solution of glue is sometimes employed; when cold, the glue is very elastic and flexible, and may be removed from almost any object without danger of breakage. These casts may be reversed in plaster, and the plaster, in turn, in metal.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

N. V. W.—No. 1 is chlorite schist containing a small amount of carbonate of nickel. In large amounts it would be valuable. No. 2 is chlerite, a hydrous silicate of alumina and magnesia, containing a small percentage of oxide of iron and sometimes a small amount of oxide of chromium. No. 3 is chlorite schist.—S. D. S.—It is obsidian, or volcanic glass. The ancient inhabitants of Mexico, before their subjugation by Cortes, used it in making sacrificial knives. It is not employed at present.—A. N. T.—No. 1 is dolomite. No. 2 is calcite. No. 3 is coccolite. No. 4 is missing. No. 5 is a mixture of calcite with some siliceous rock—too indefinite to admit of separation. No. 6 is arenaceous limestone.—T. L.—The coal contains only a small percentage of sulphur, not enough to make it objectionable for the purpose you mention. It is a very compact variety of bituminous coal of excellent quality.—F. L. L.—The specimens you send us contain a considerable percentage of nickel, also chalcopyrite and iron pyrites.—H. W. S.—It is trap rock containing small specks of iron pyrites.—E. A.—The mineral found near a lead mine is iron pyrites (sulphide of iron) in indurated clay. The other piece is shale.—E. W.—It is clay containing carboniferous matter of no particular value.—E. F. T.—The shell is made artificially of plaster of Paris moistened with a strong solution of alum together with the perfume, pressed into molds, and dried. The camphor cake contains pipe clay, chalk, magnesia, and a little starch besides the camphor.—J. N. C. (Fredericktown, O.), G. H. (Windsor Locks, Conn.), C. P. (Marysville, Tenn.), S. N. (Forest Station, Shenandoah county, Va.), send us letters of inquiry as to minerals, but no specimens which we are able to identify. If correspondents will not put their names on the boxes which they send (and several such boxes come through the mail at one time) it is very difficult and in some cases impossible to identify the senders.

D. M. asks: What preparation can be used on tenor drums, which will be waterproof and at the same time stand the beating?—J. B. C. asks: Is there any demonstration to the following theorem? Draw three circles of any unequal diameters, as A, B, C. Produce the tangent lines, as shown, until they meet, from A through B, from A through C, and B through C. It will be found in all cases that the meeting points are in a straight line, as 1, 2, and 3 in the straight line, D E. The same result is obtained in whatever position the circles may be placed, or under any variations of their diameters, provided they are all unequal.



COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the True Science of Religion. By T. B. McC.
On Boiler Explosions. By T. J. B.
On Cutting Tools. By J. R.
On Ventilation. By G. W. W.
On the United States Patent Association. By J. A. R.
On the Expansion of Superheated Steam. By G. A. W.
On Steel. By G. W. T.
On Aeronautics. By C. E. D.
On the Mississippi Jetties. By A. S.
On Violins. By E. P. W.
On Calipers. By E. R.

Also inquiries and answers from the following:

J. M. McF.—A. S.—F. O. H.—T. J. B.—F. W. N.—J. H. D.—J. G.—R. F. W.—P. Q.—N. O.—A. W. K.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells castings for small steam engines? Who sells malleable glass lamp chimneys? Who sells foot power band saws? Who sells the flexible shafting exhibited at the Centennial? Whose is the best aneroid barometer?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained

[OFFICIAL.]

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FOR WHICH

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November 7, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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9,612.—INKSTANDS.—J. B. Davids, New York city.
9,613.—INKSTANDS.—O. F. FOGELSTRAND, Kensington, Conn.
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,615.—PRINTING BORDER.—R. Smith, Philadelphia, Pa.

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9,617.—DRINKING FOUNTAIN.—J. W. Fiske, New York city.
9,618, 9,619.—MATCH-SAFES.—O. F. Fogelstrand, Kensington, Conn.
9,620.—CARPETS.—R. R. Campbell, Lowell. Mass.
9,621 to 9,628.—CARPETS.—J. M. Christie, Kidderminster, England.
9,629 to 9,632.—CARPETS.—J. Fisher, New York city.
9,633.—CARPETS.—A. L. Halliday, New York city.
9,634.—CARPETS.—E. J. Ney, Lowell, Mass.
9,635.—CARPETS.—F. F. Ricker, Lowell, Mass.
9,636.—CARPETS.—T. J. Stearns, Boston, Mass.
9,637 to 9,639.—CARPETS.—C. W. Swapp, Lowell, Mass.

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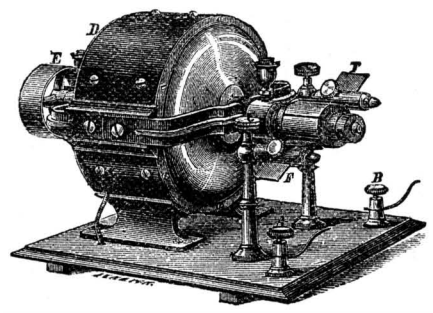

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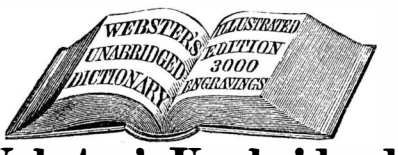

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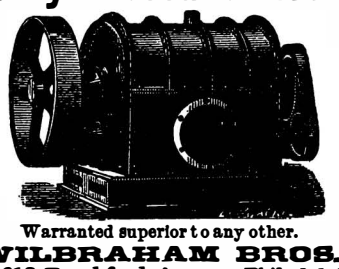

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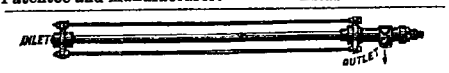

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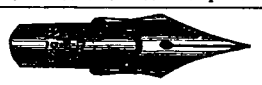
THE  BEST
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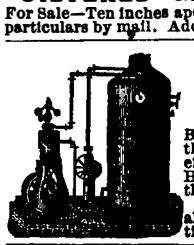

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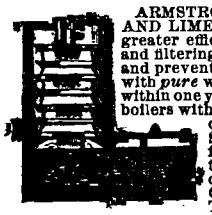

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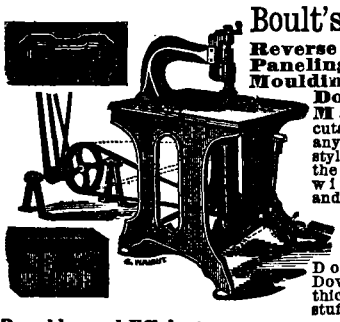

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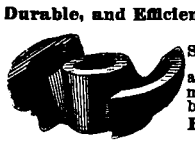

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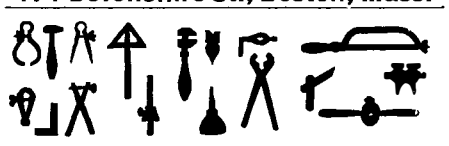

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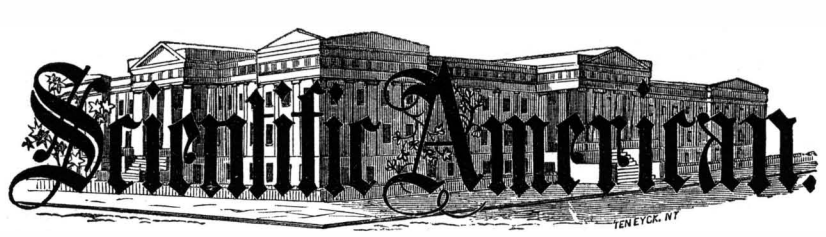

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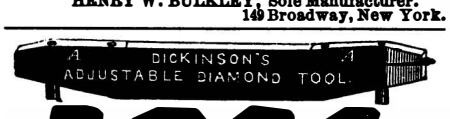

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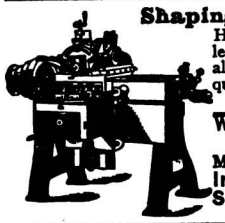
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